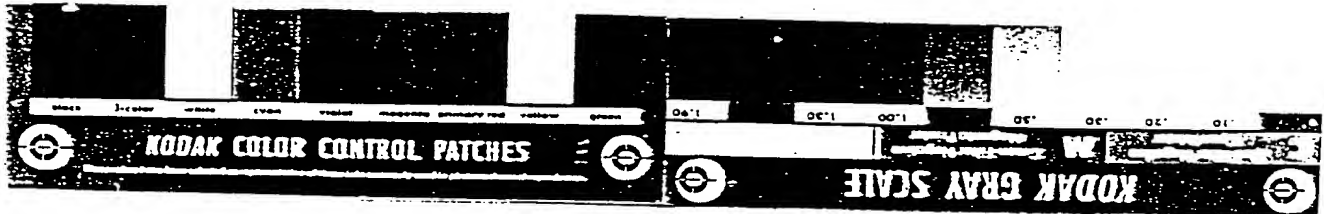


Fig. 1

Color comparison of various passive layers



Substrate: Zinc-plated screws

Blue chromation: Left picture half

Invention: Center

Yellow chromation: Right picture half

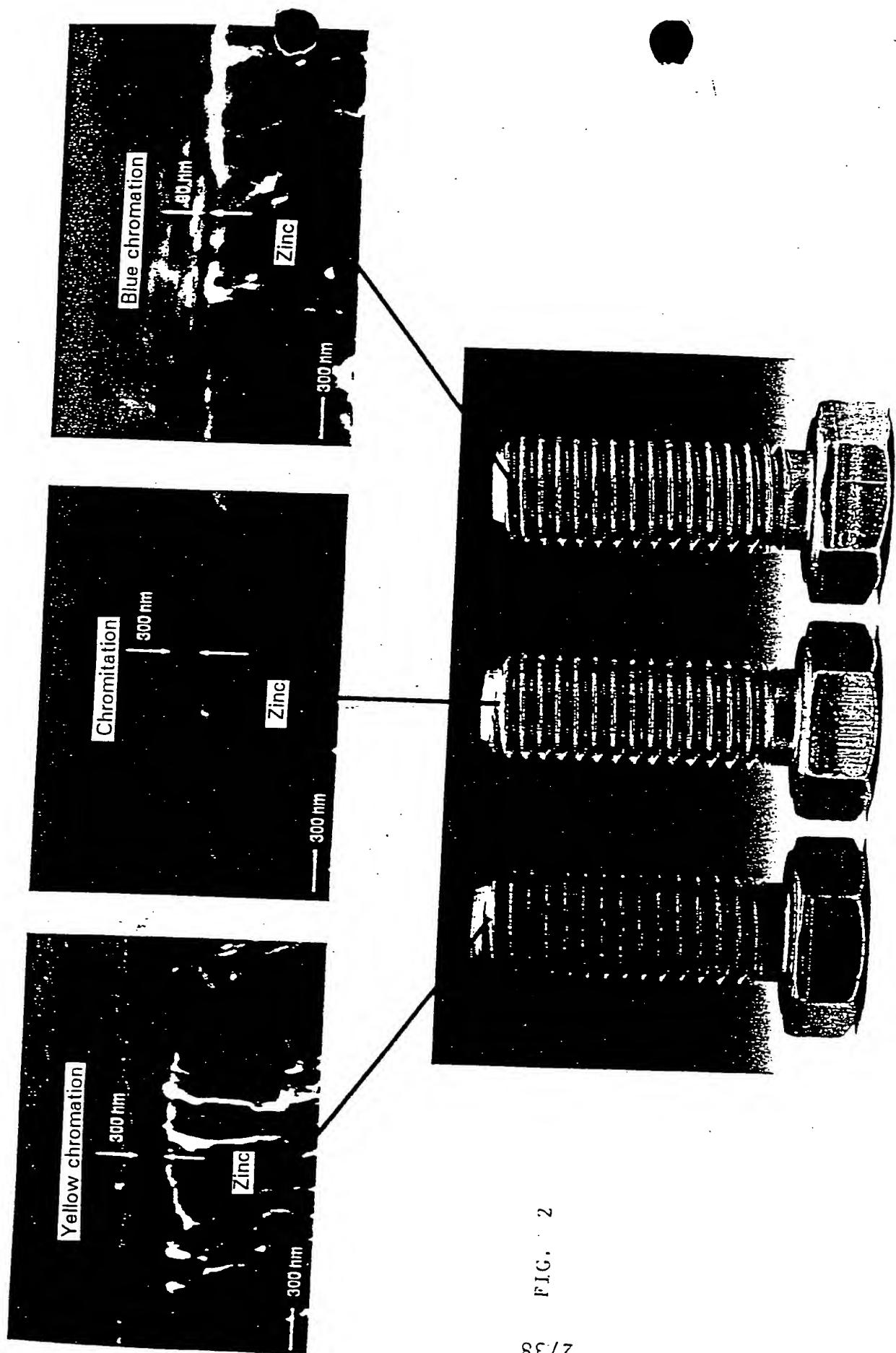


FIG. 2

Fig. 3

Bandwidth of iridescence according to the present invention
(on zinc-plated screws)

09904993-071301

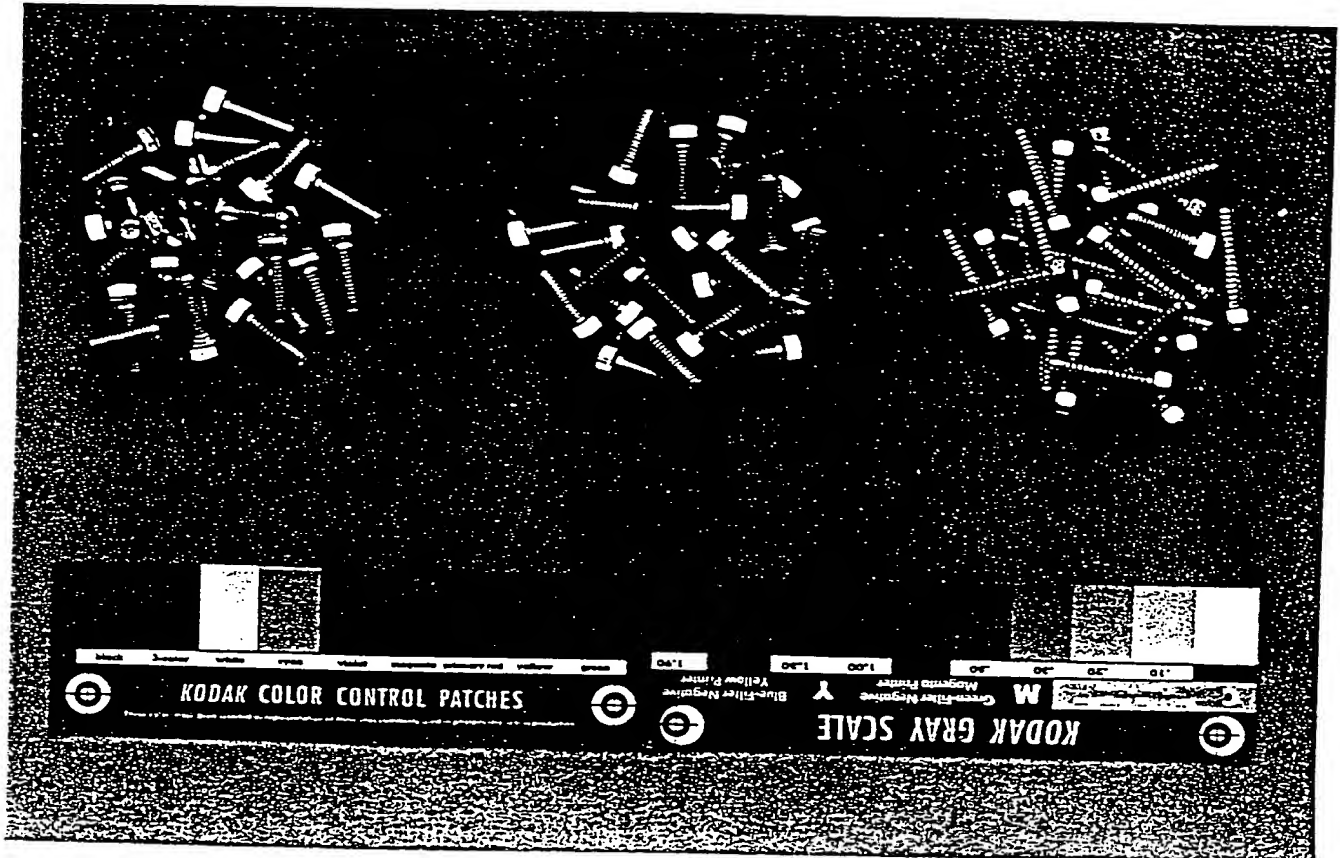
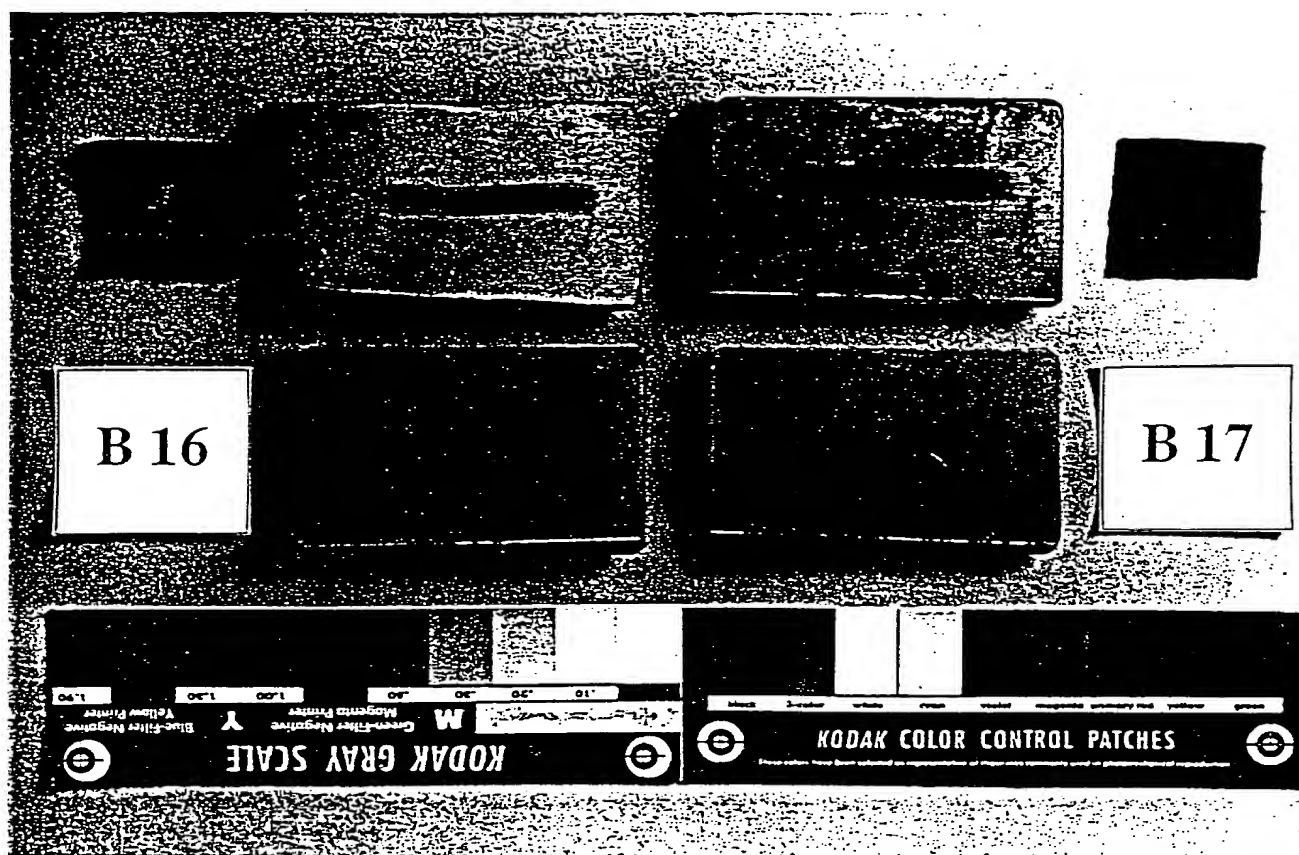


Fig. 4

Comparison test with EP 0 034 040

Example 16

Example 17

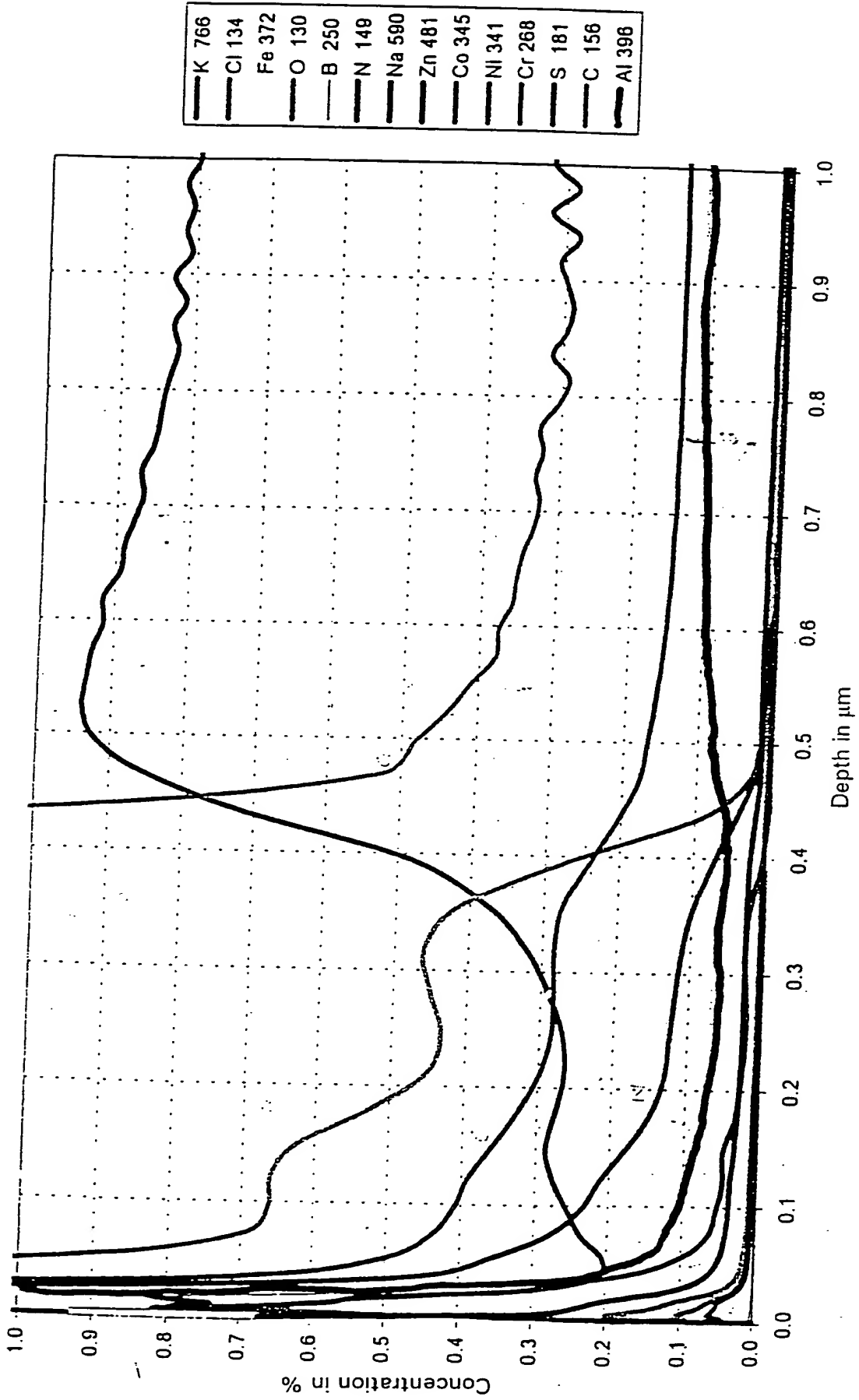


The upper picture half, one the outer left and right, shows a black cloth whereby the abrasions on the metal sheets shown in the top picture half were obtained. Layer portions - discernible as whitish stains - are on both pieces of cloth. The lower picture half shows the unmarred layers of the prior art.

Substrate: Zinc-plated steel sheet.

TOE F 20 E 66 H 0 6 6 0 Diagram 1

Pattern 1, Measurement Position A



TID 25570660

Pattern 1, Measurement Position A

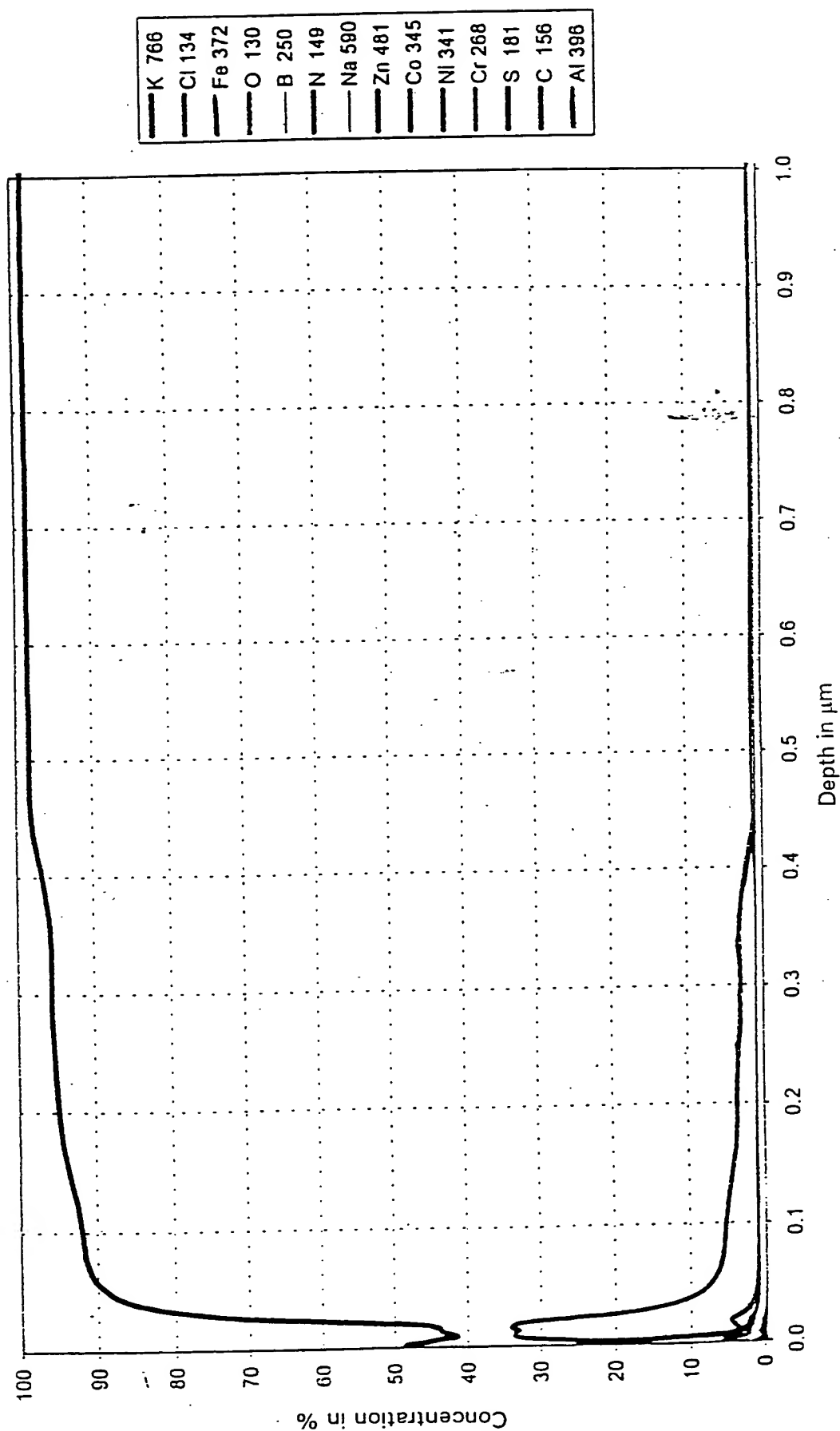


Diagram 1
TDEP-20-EBH0000

Sample 1, Measurement Position B

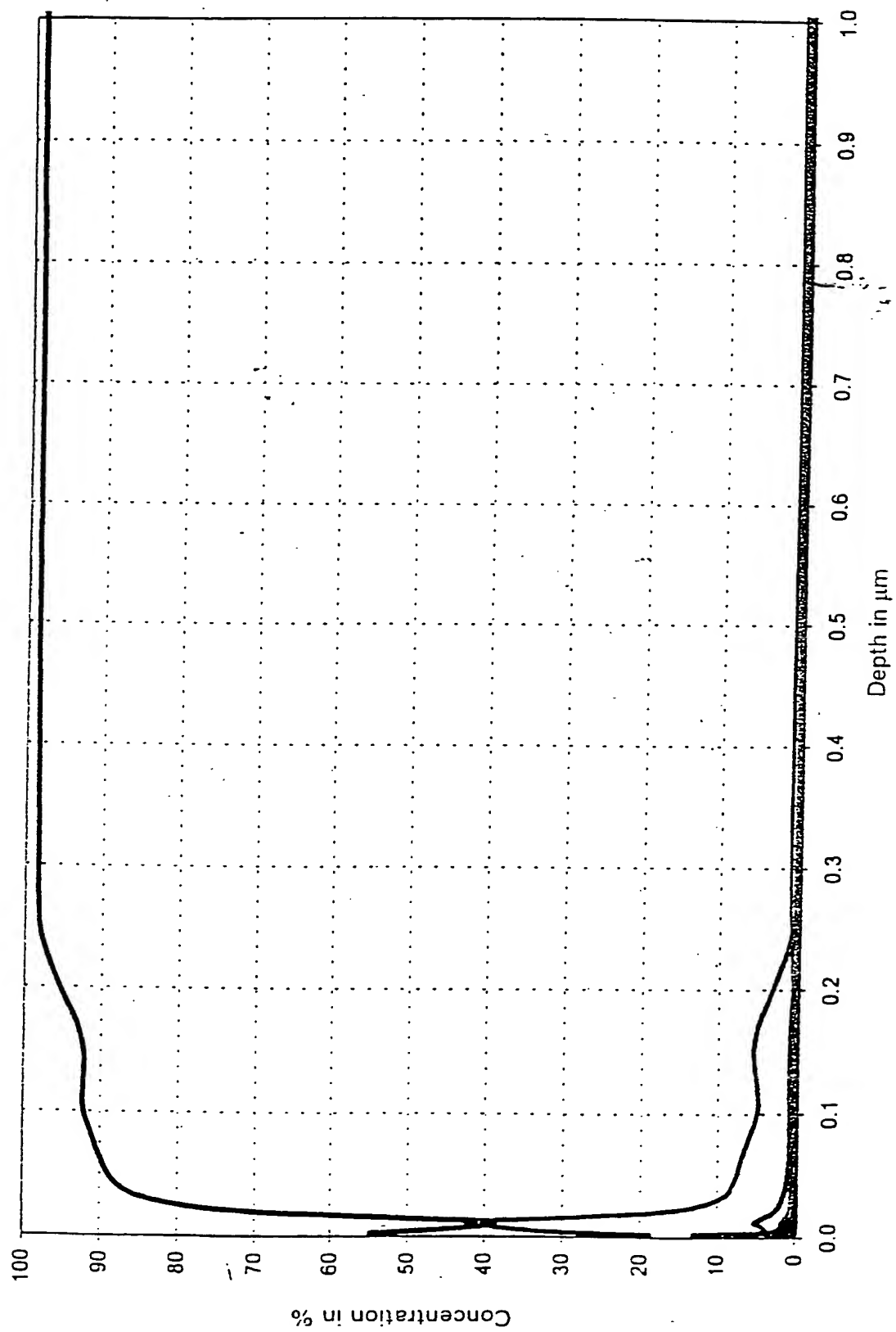


Diagram 2
Sample 1, Measurement Position B

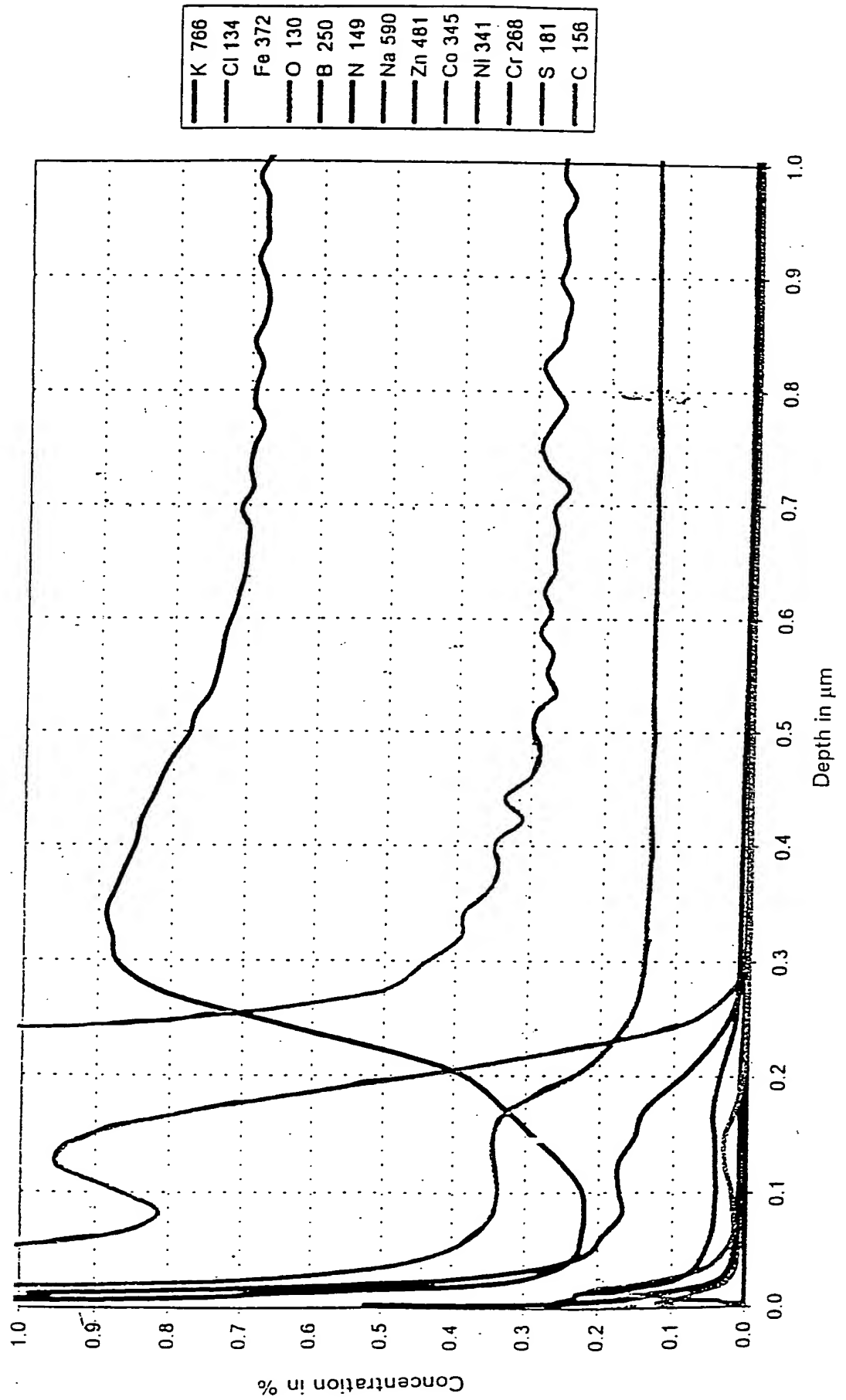
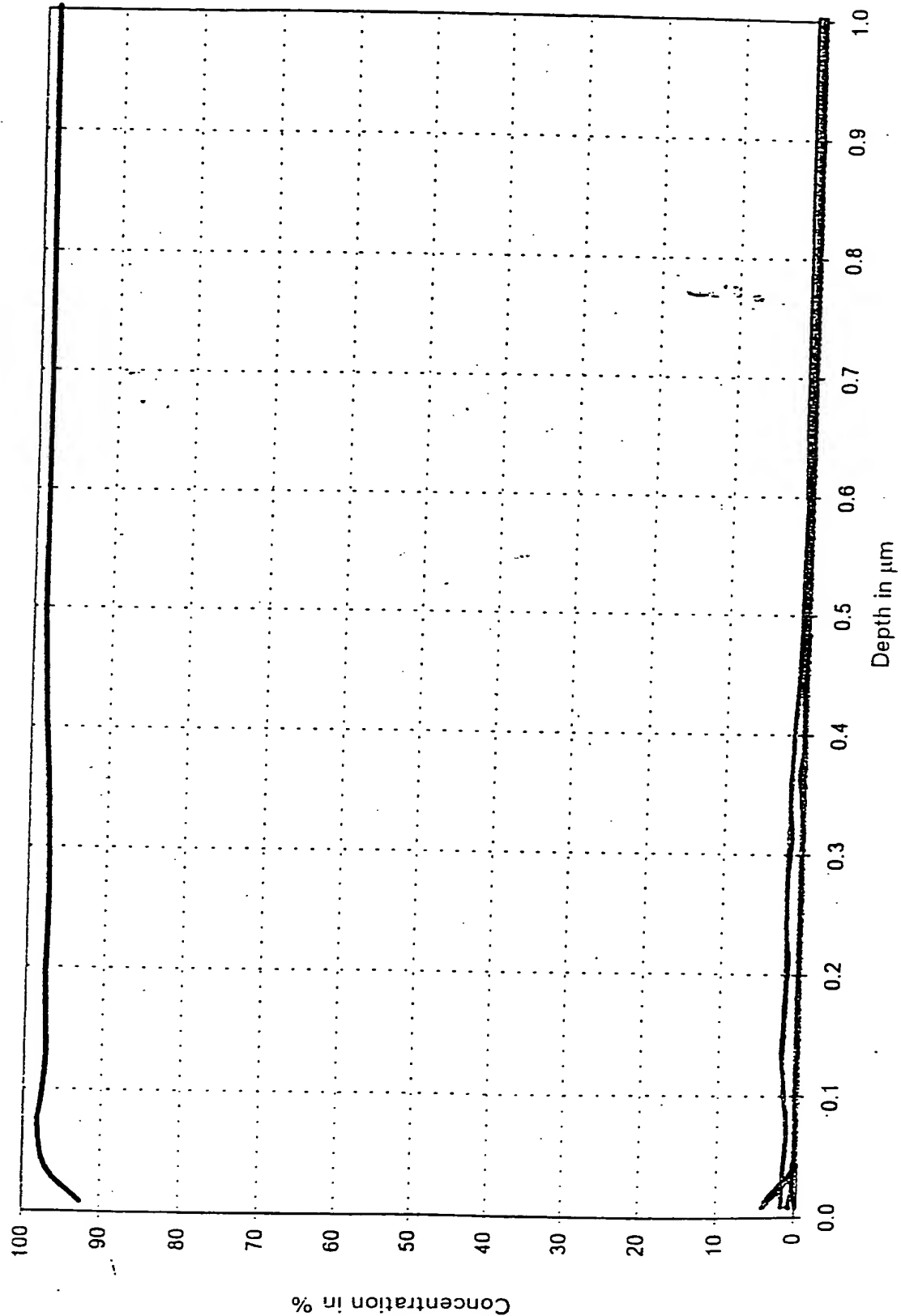


FIG. 8

TUEF20-EE64060

Sample 2, Measurement Position A



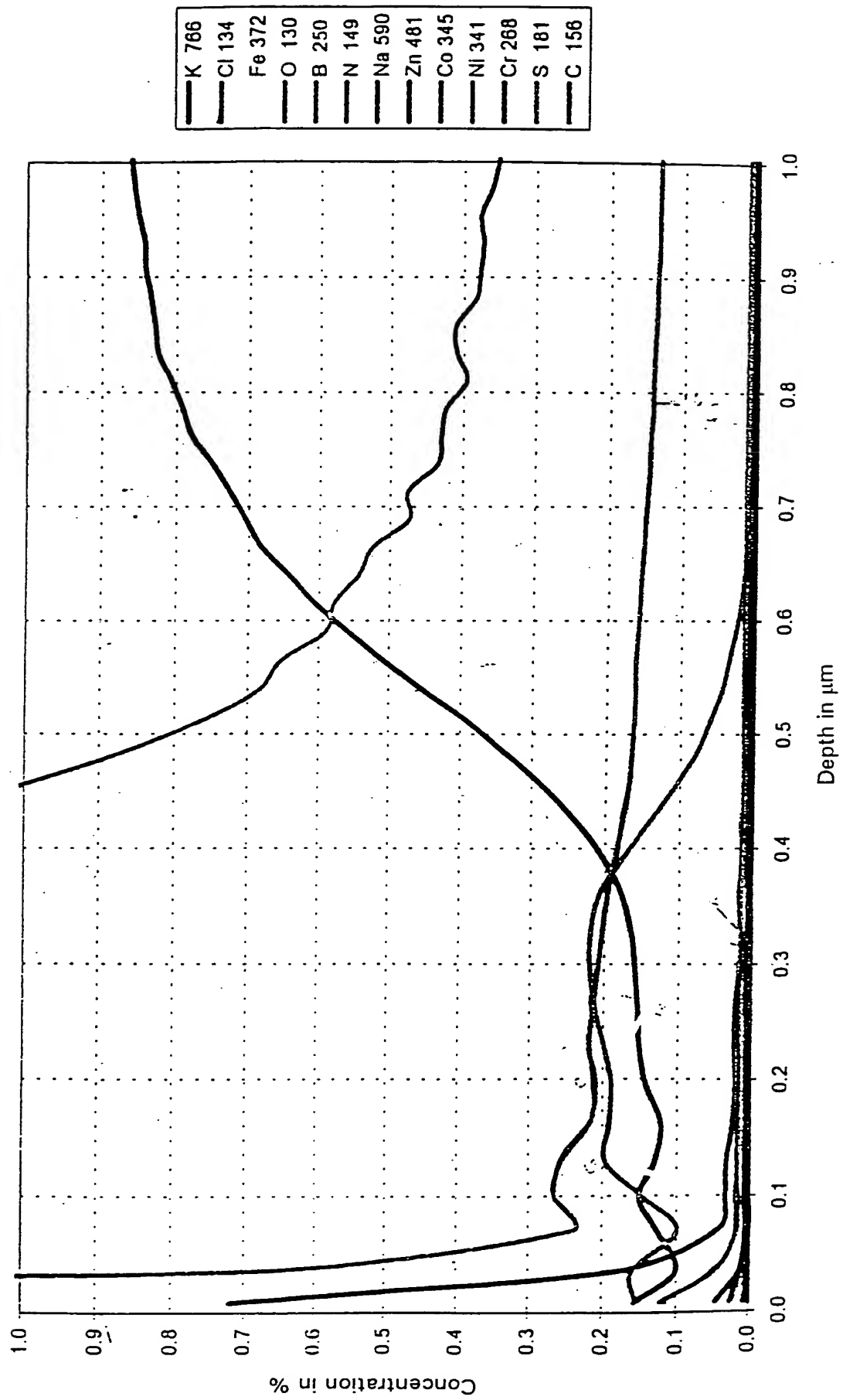
| | |
|---|--------|
| — | K 766 |
| — | Cl 134 |
| — | Fe 372 |
| — | O 130 |
| — | B 250 |
| — | N 149 |
| — | Na 590 |
| — | Zn 481 |
| — | Co 345 |
| — | Ni 341 |
| — | Cr 288 |
| — | S 181 |
| — | C 156 |

T0E120" E6640550

Diagram 2

Sample 2, Measurement Position A

FIG. 10



TEF20" E6670660

Diagram 1

Sample 2, Measurement Position B

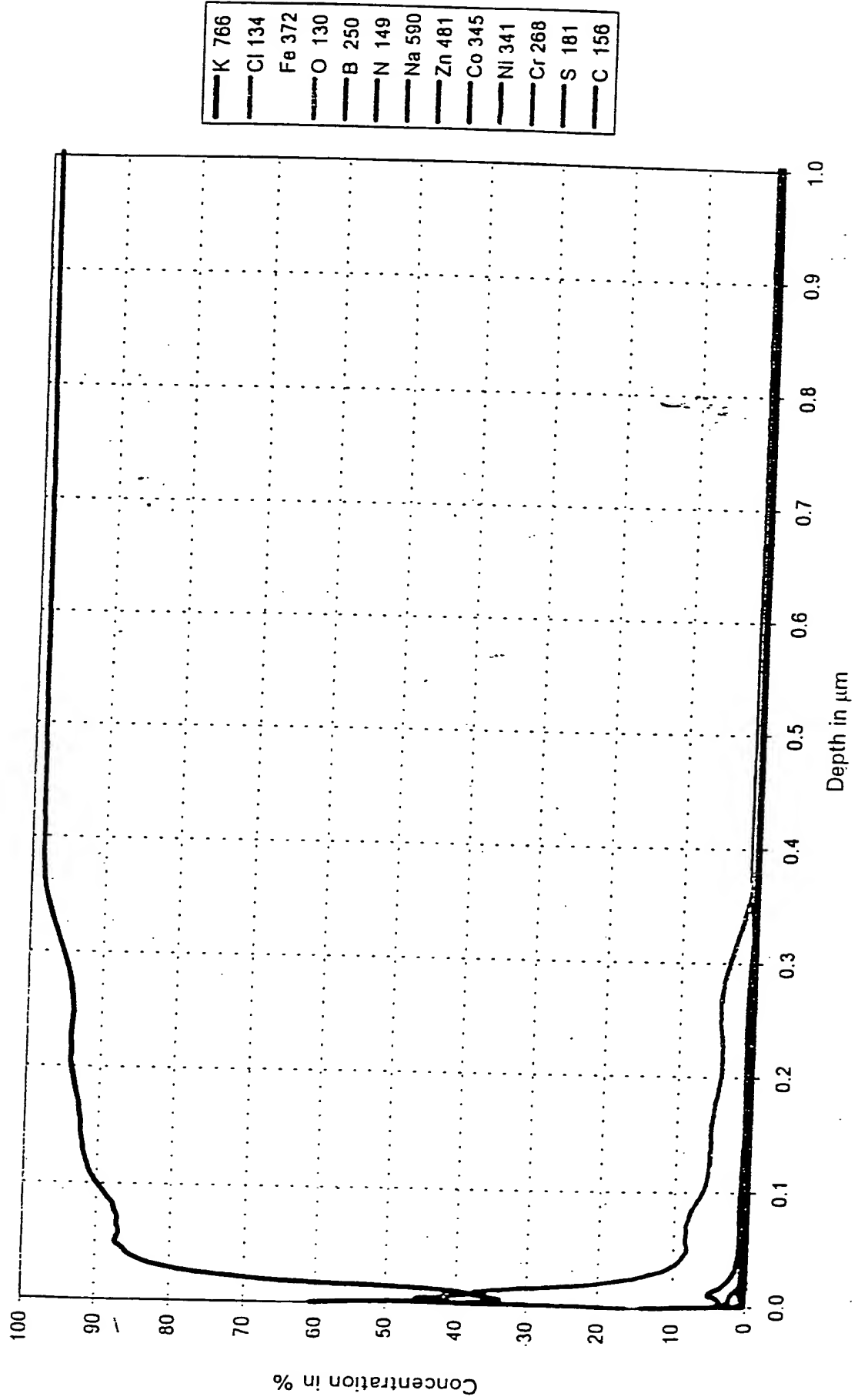
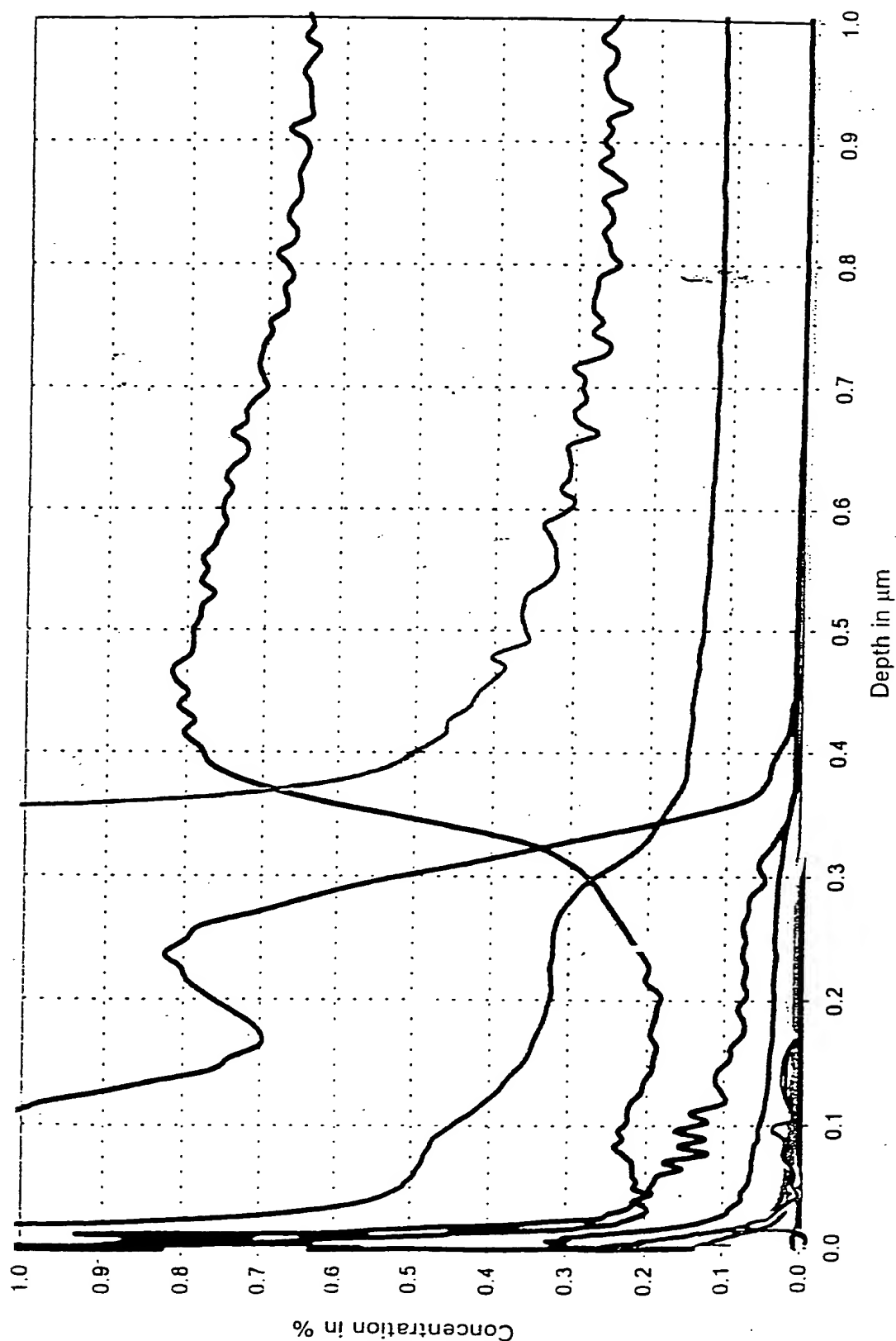


FIG. 11

FIG. 12

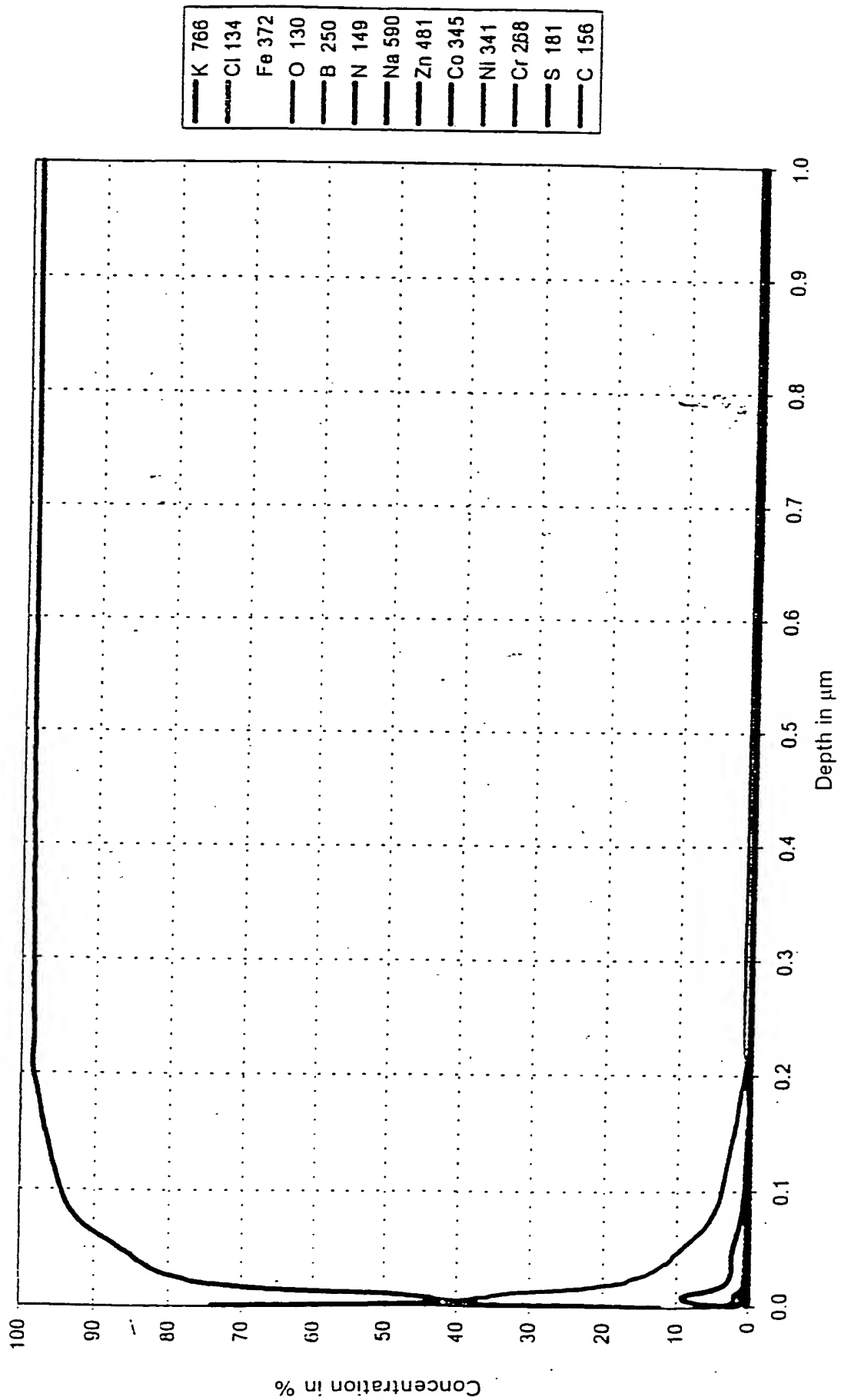
Diagram 2

Sample 2, Measurement Position B

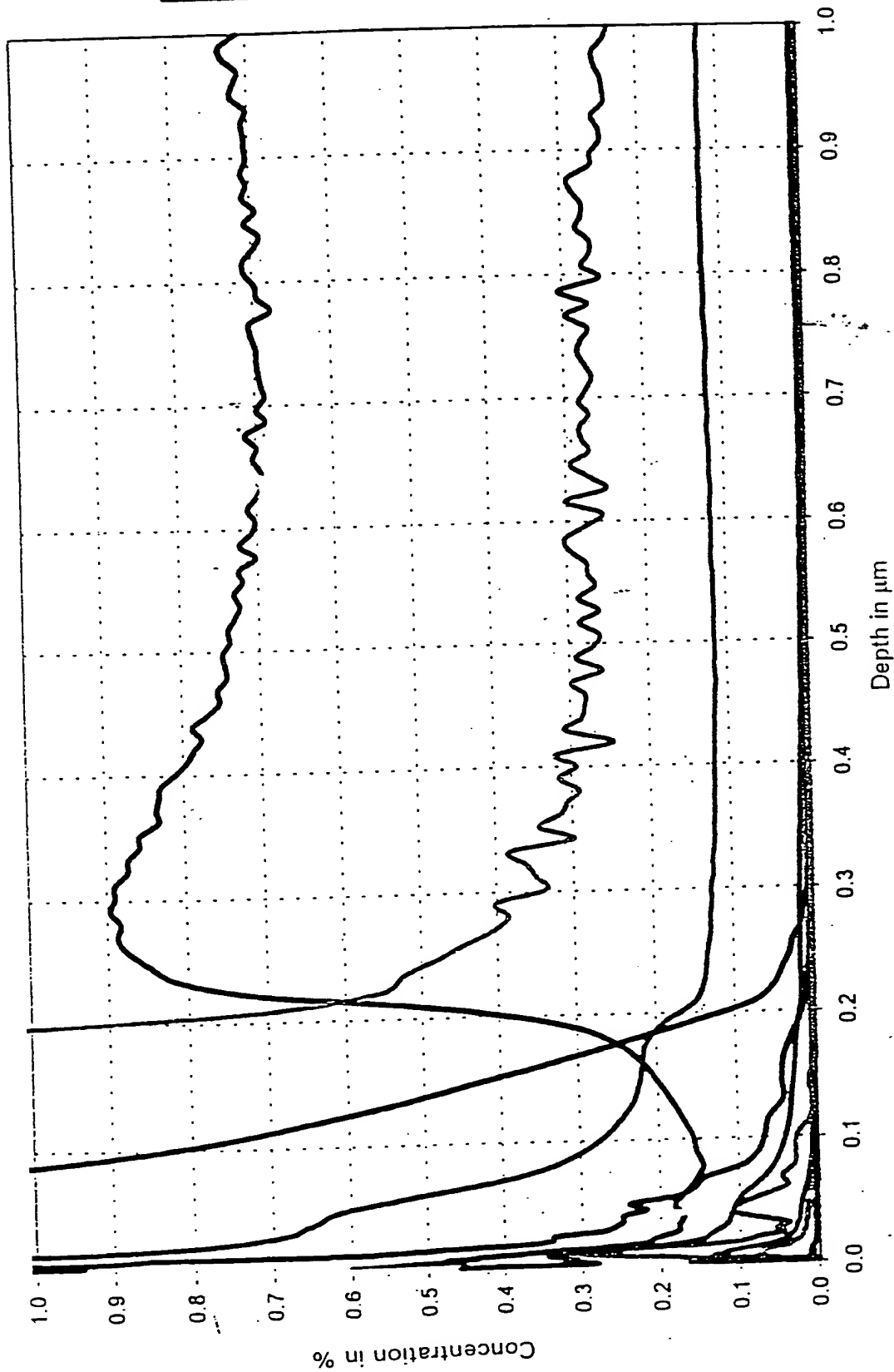


TOP 40 ELEMENTS
Diagram 1

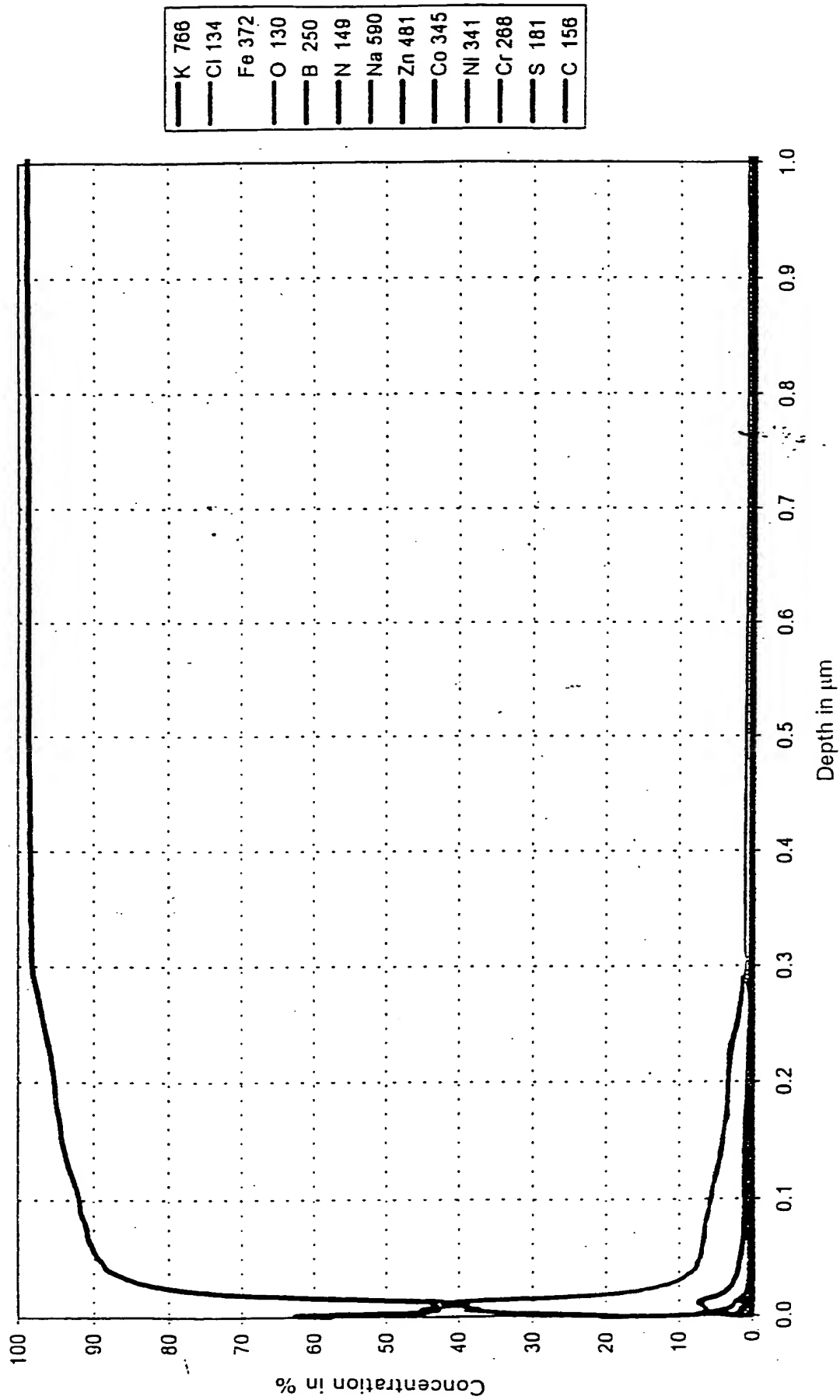
Sample 3, Measurement Position A



Sample 3, Measurement Position A



Sample 4, Measurement Position A



Sample 4, Measurement Position A

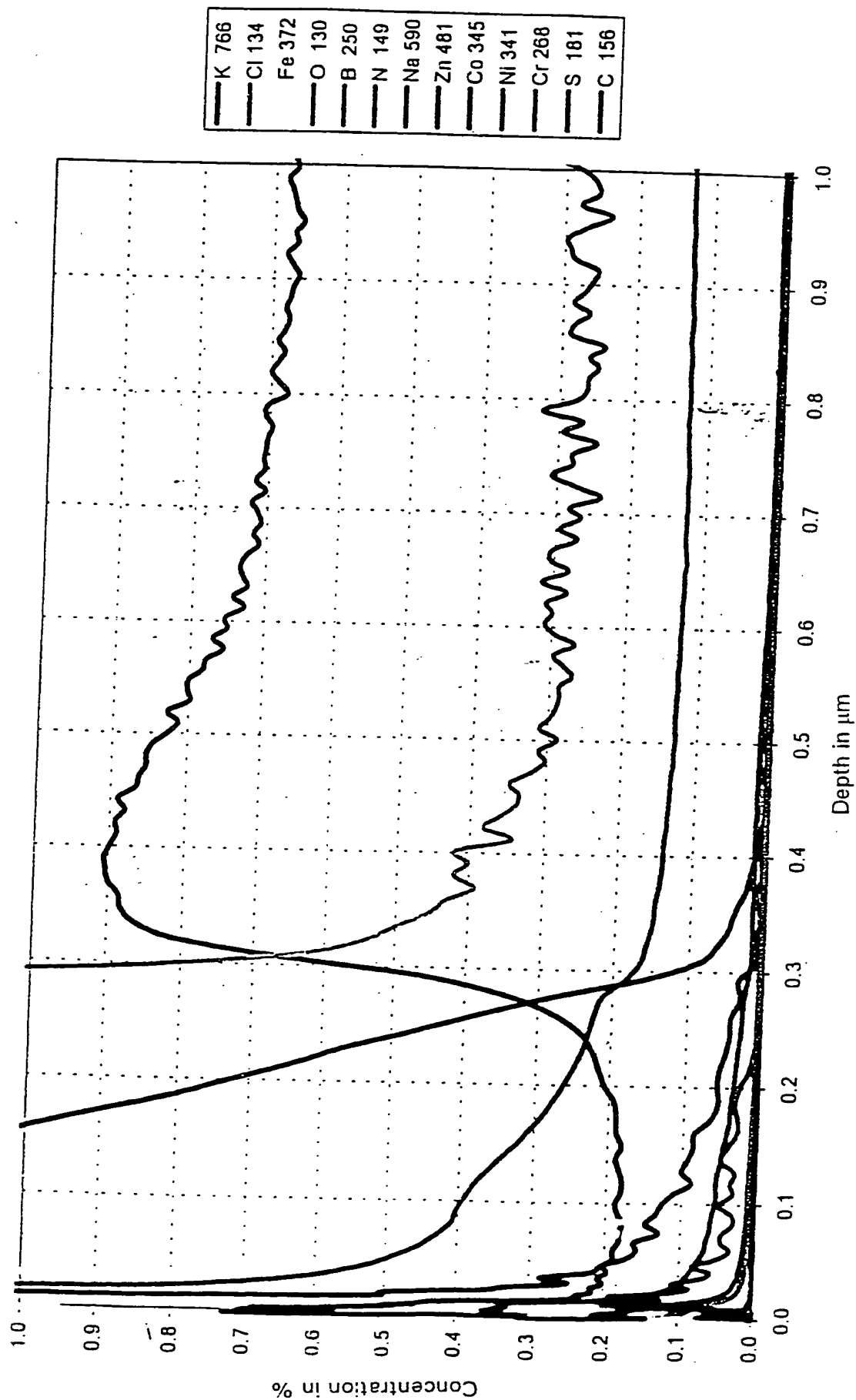
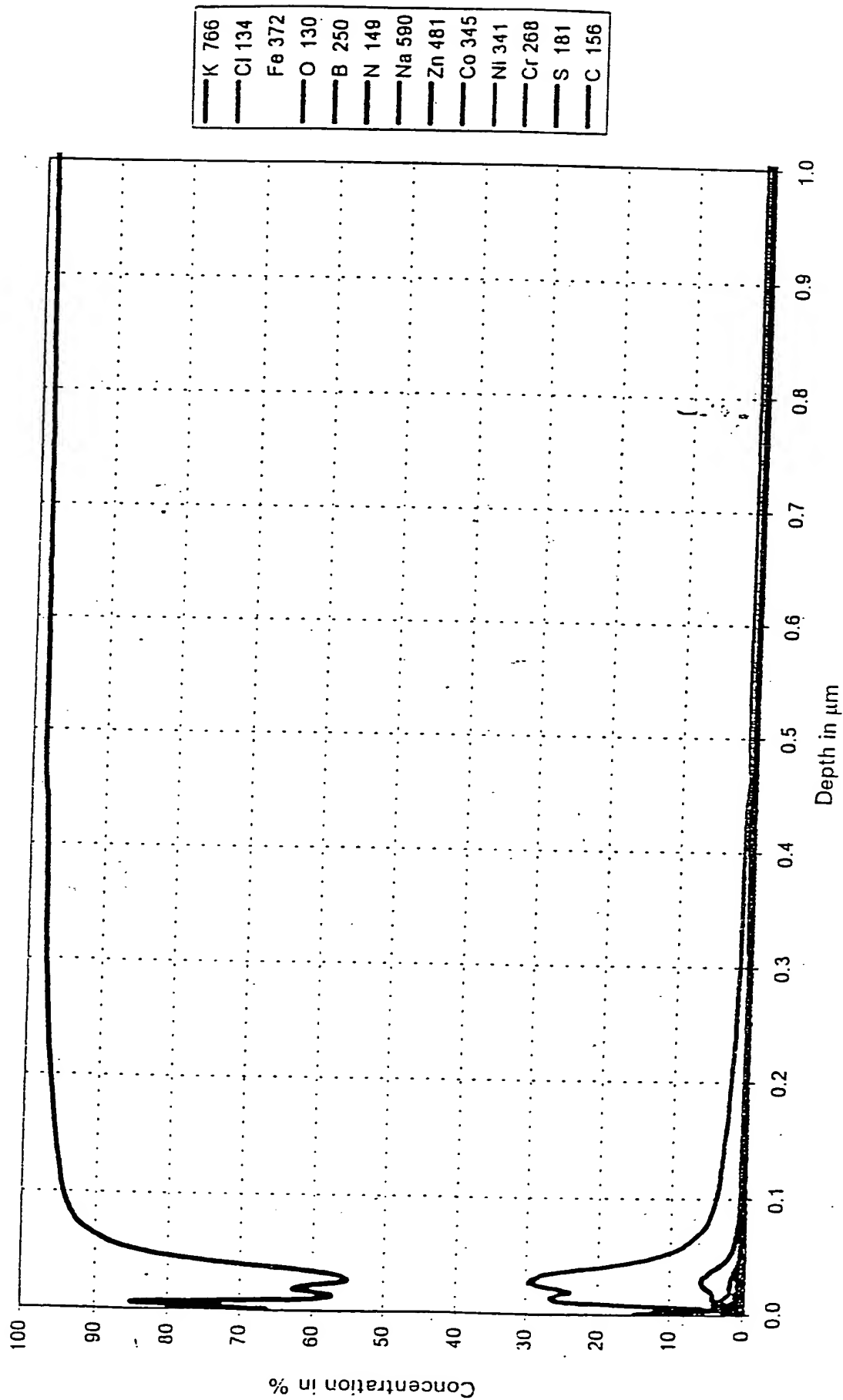


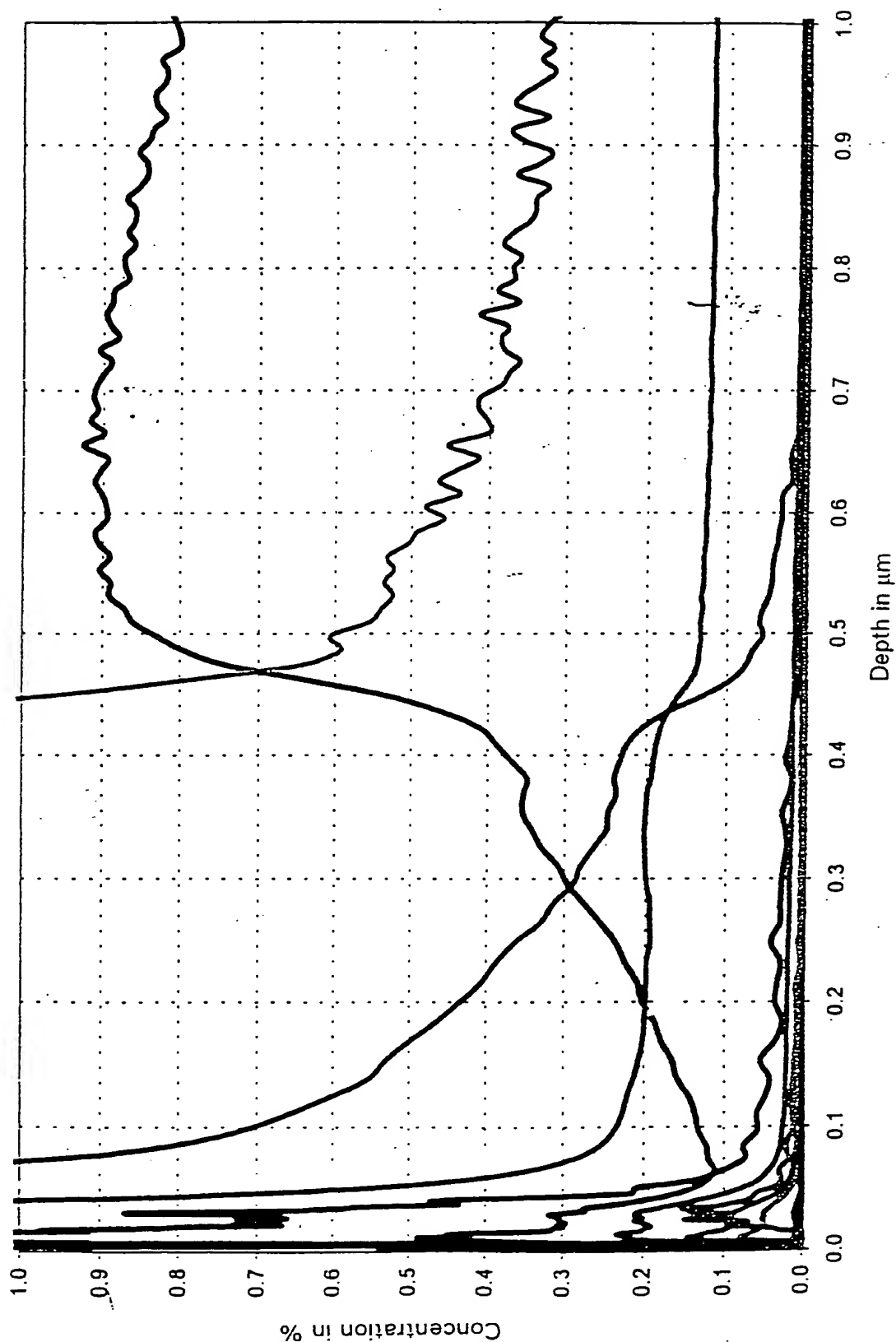
FIG. 16

TOE-20" ECHO-600
Diagram 1

Sample 5, Measurement Position A



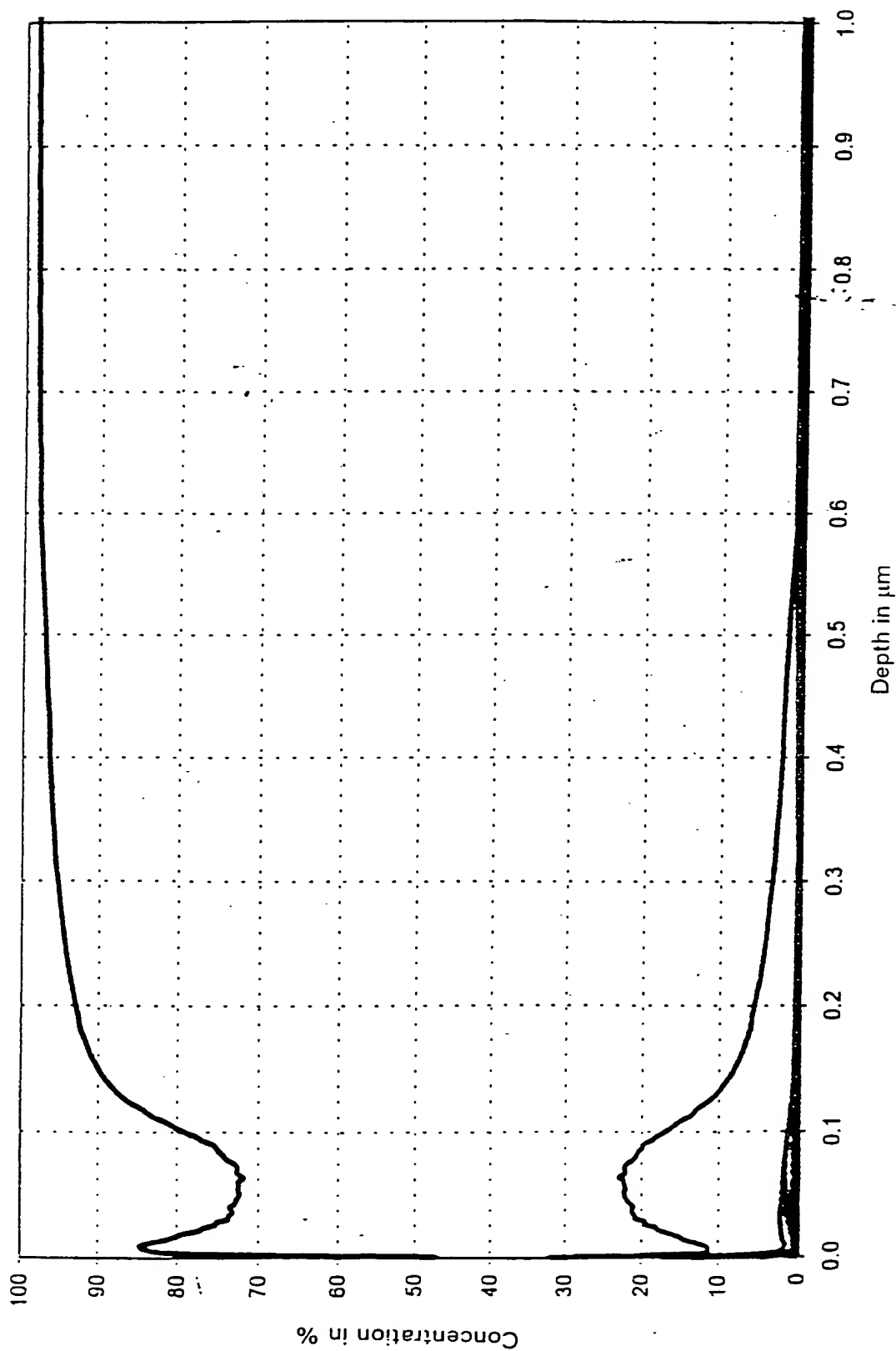
| | |
|---|--------|
| — | K 766 |
| — | Cl 134 |
| — | Fe 372 |
| — | O 130 |
| — | B 250 |
| — | N 149 |
| — | Na 590 |
| — | Zn 481 |
| — | Co 345 |
| — | Ni 341 |
| — | Cr 268 |
| — | S 181 |
| — | C 156 |



Sample 5, Measurement Position A

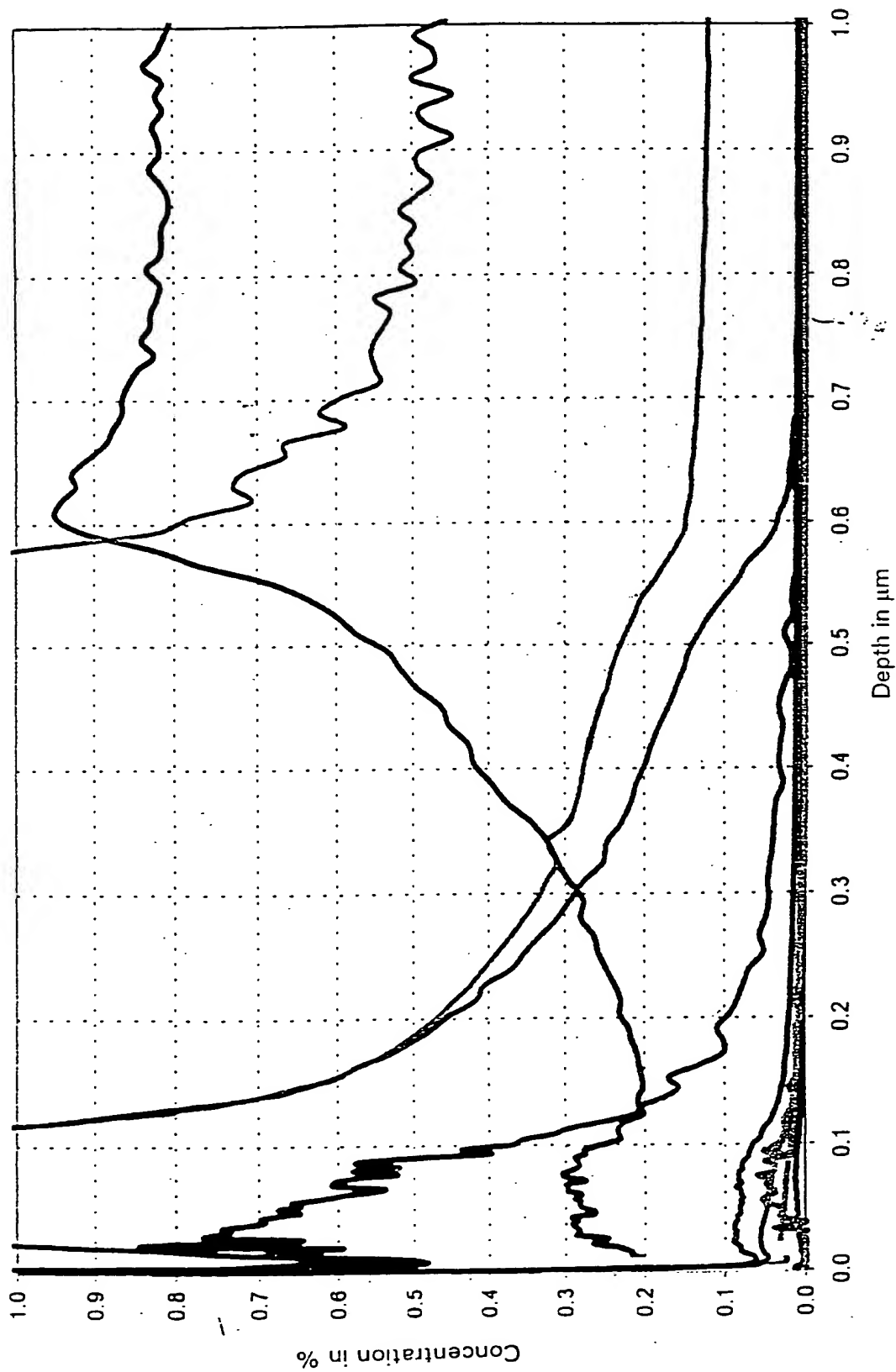
Diagram 2

Sample 6, Measurement Position A



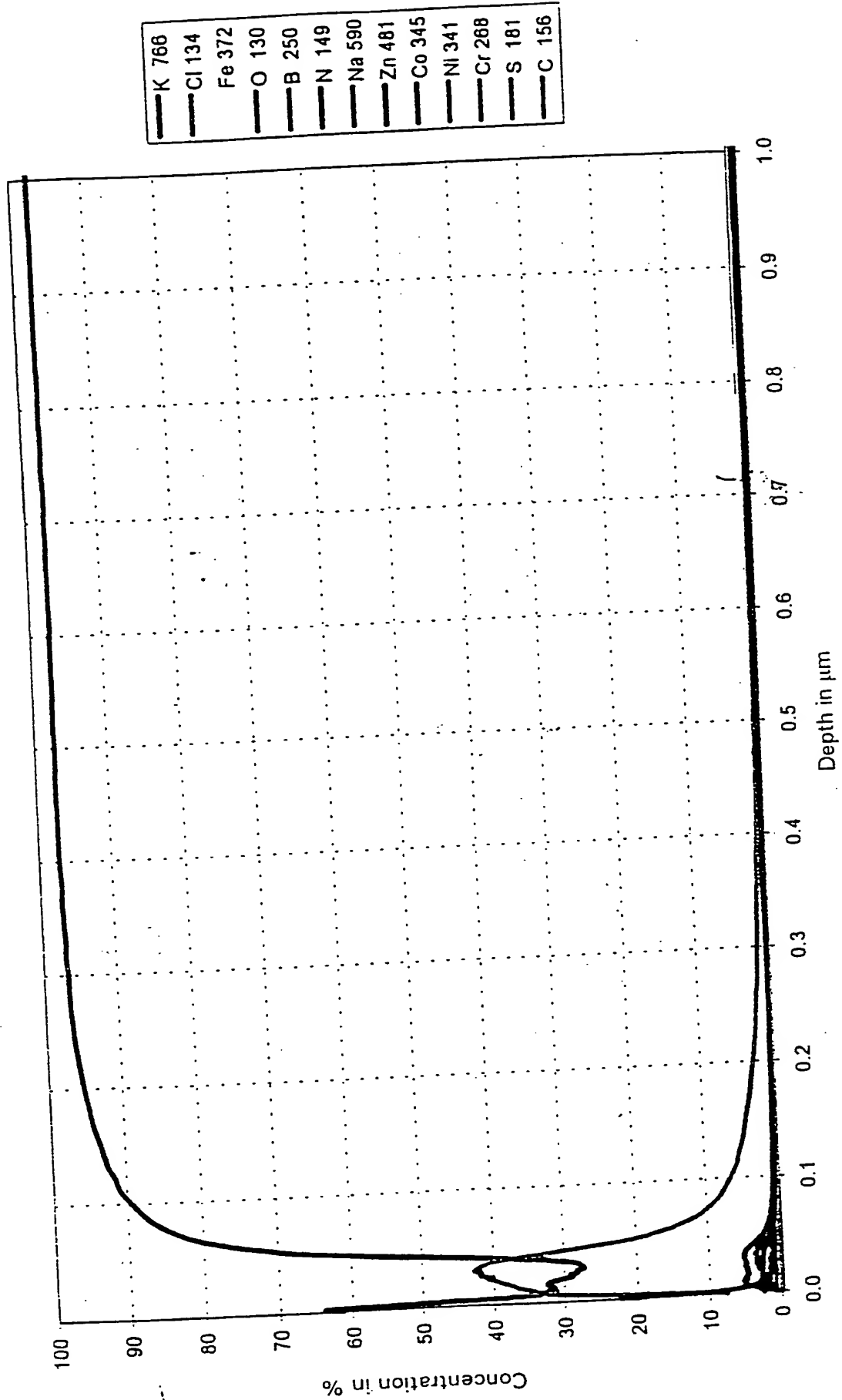
| |
|----------|
| — K 768 |
| — Cl 134 |
| — Fe 372 |
| — O 130 |
| — B 250 |
| — N 149 |
| — Na 590 |
| — Zn 481 |
| — Co 345 |
| — Ni 341 |
| — Cr 268 |
| — S 181 |
| — C 156 |

Sample 6, Measurement Position A

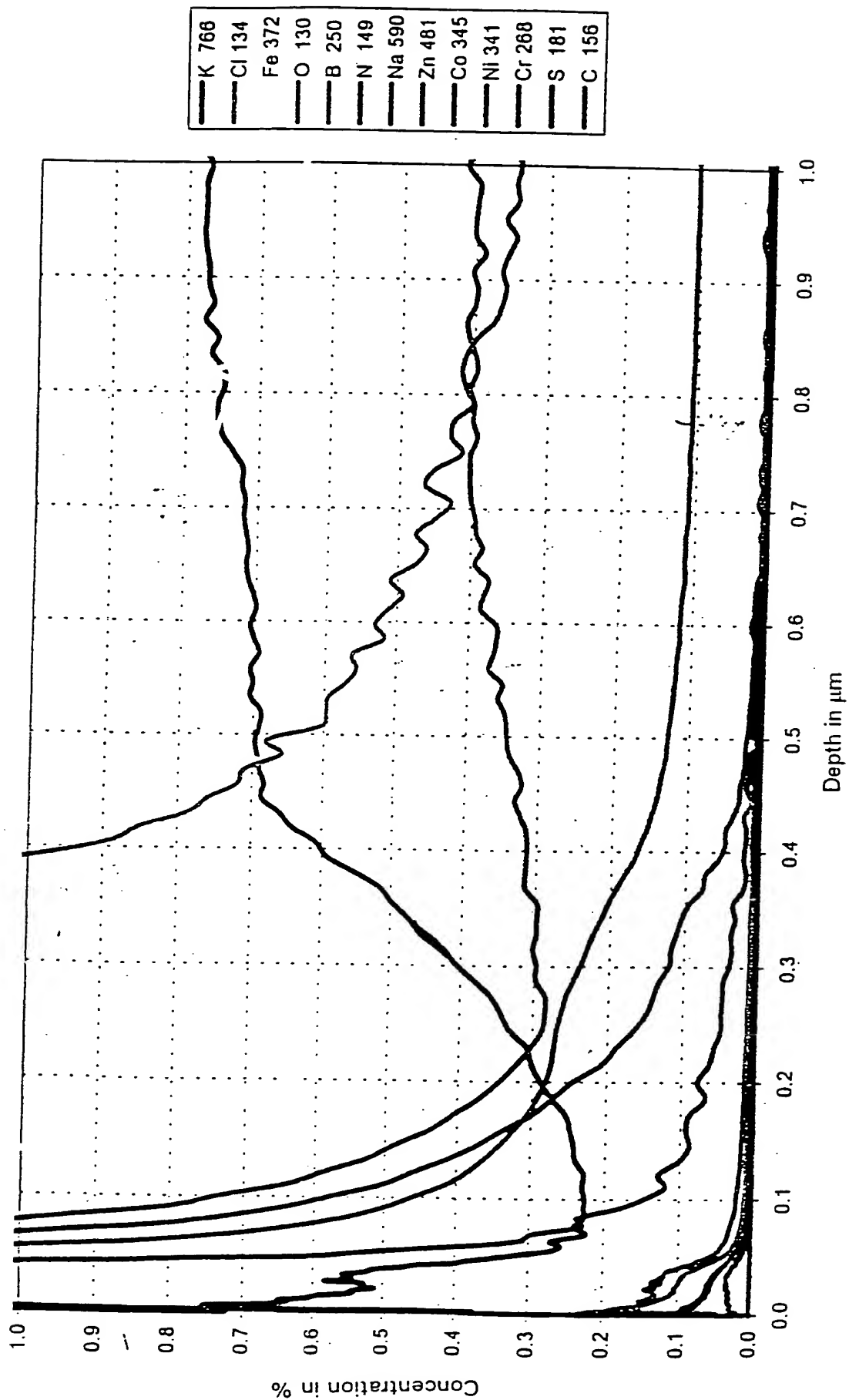


Sample 6, Measurement Position B

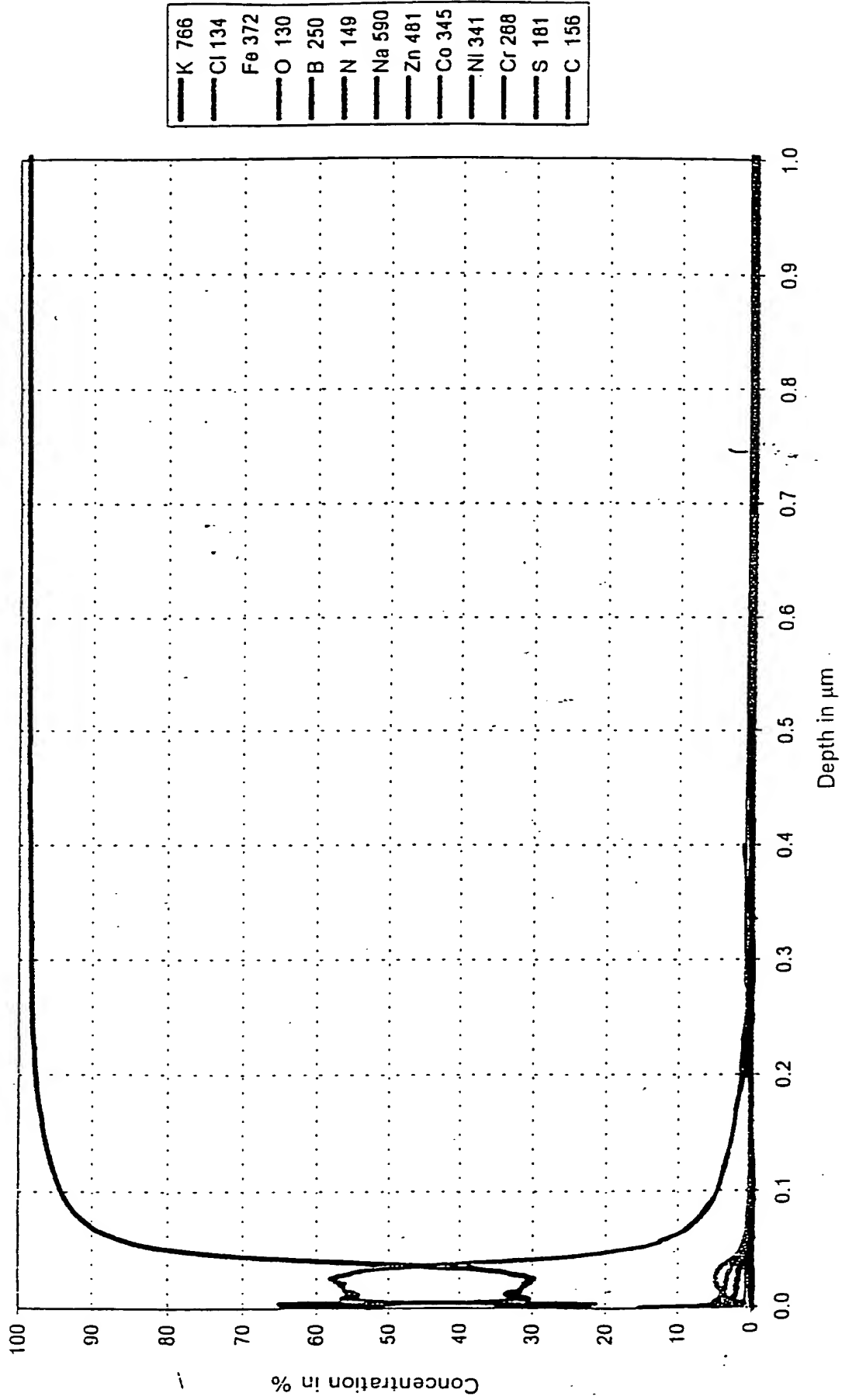
FIG. 21

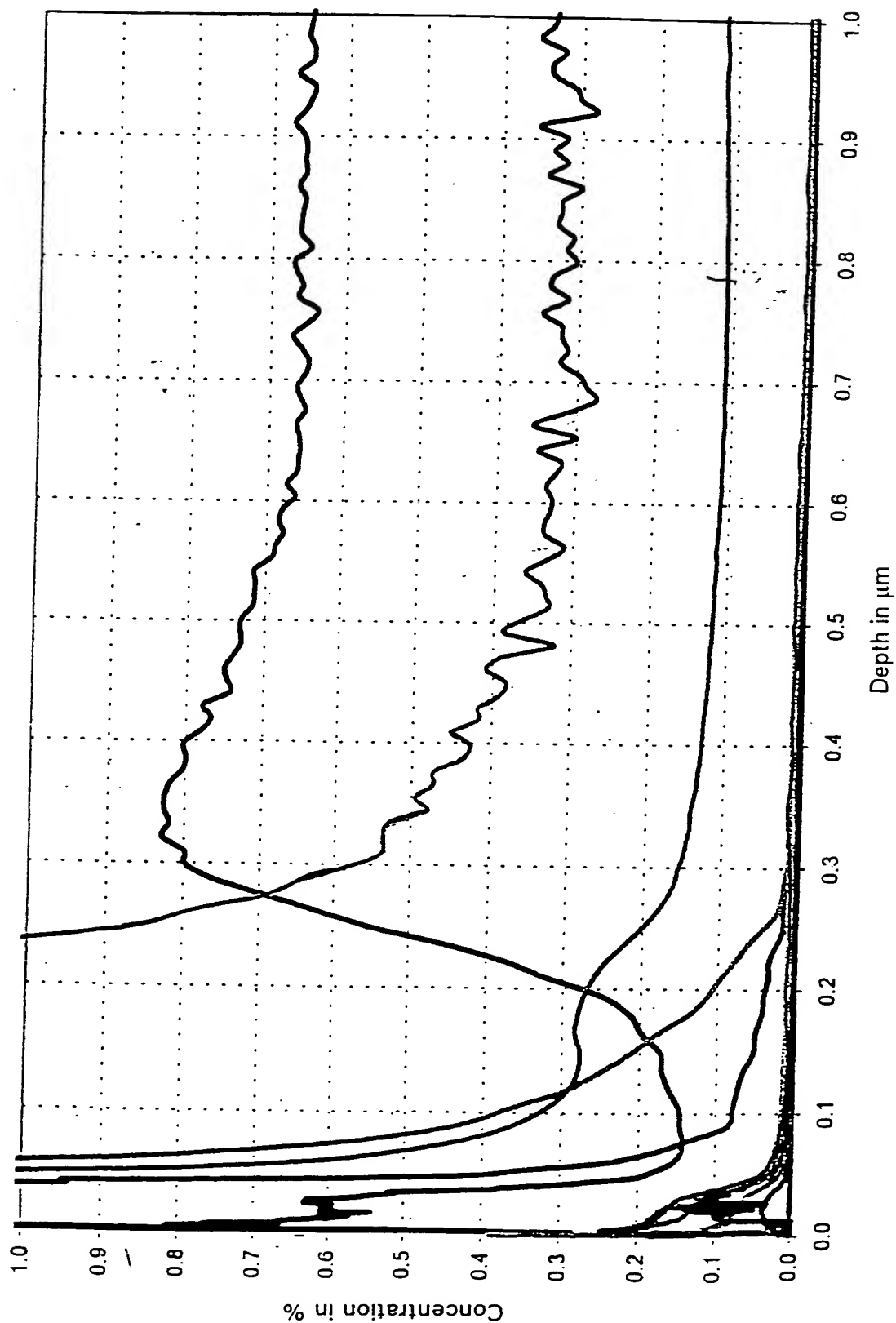
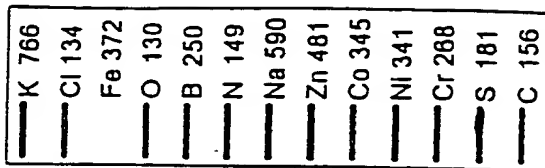


Sample 6, Measurement Position B



Sample 6, Measurement Position C





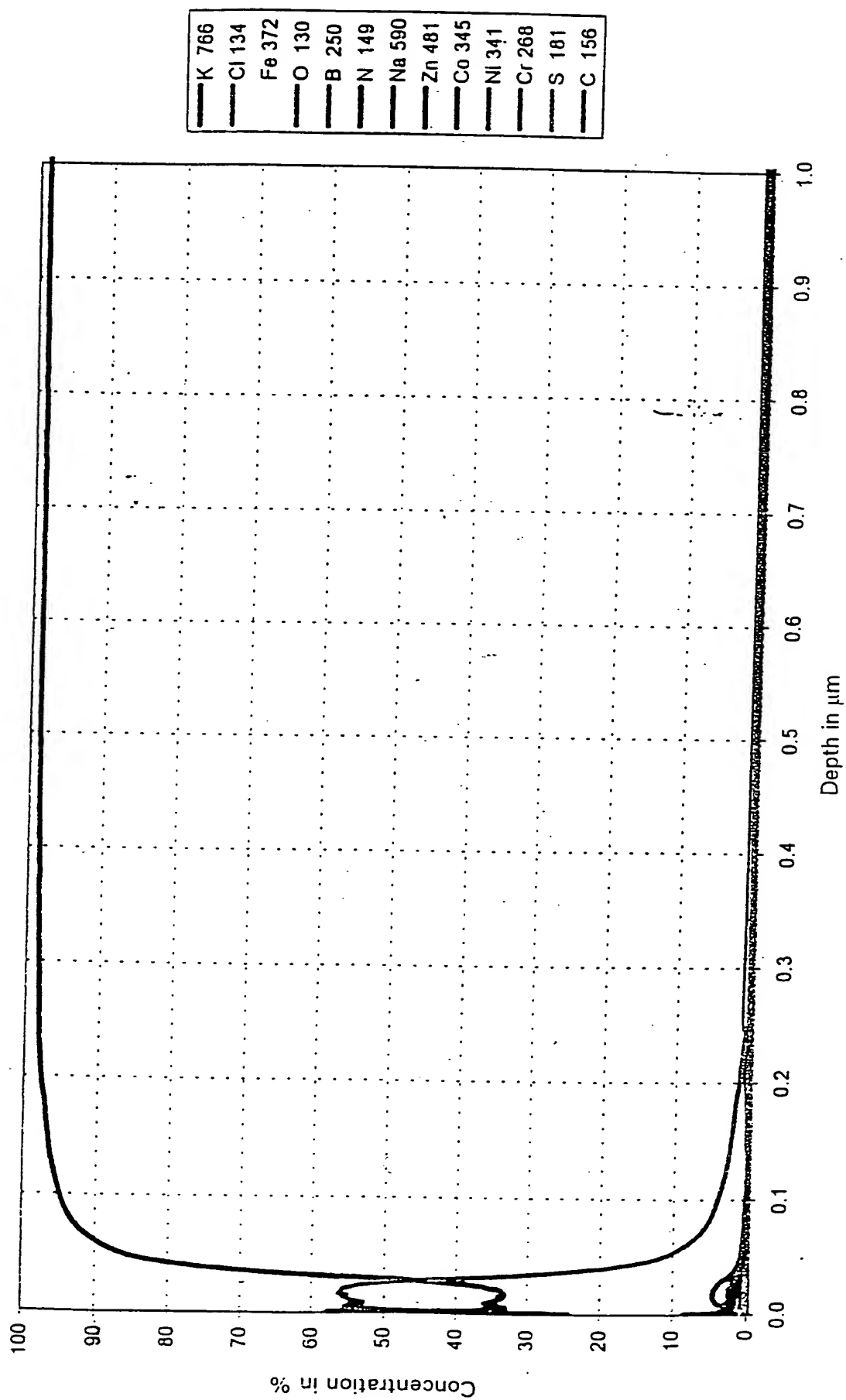
Sample 6, Measurement Position C

Diagram 2

FIG. 25

Diagram 1

Sample 6, Measurement Position D



Sample 6, Measurement Position D

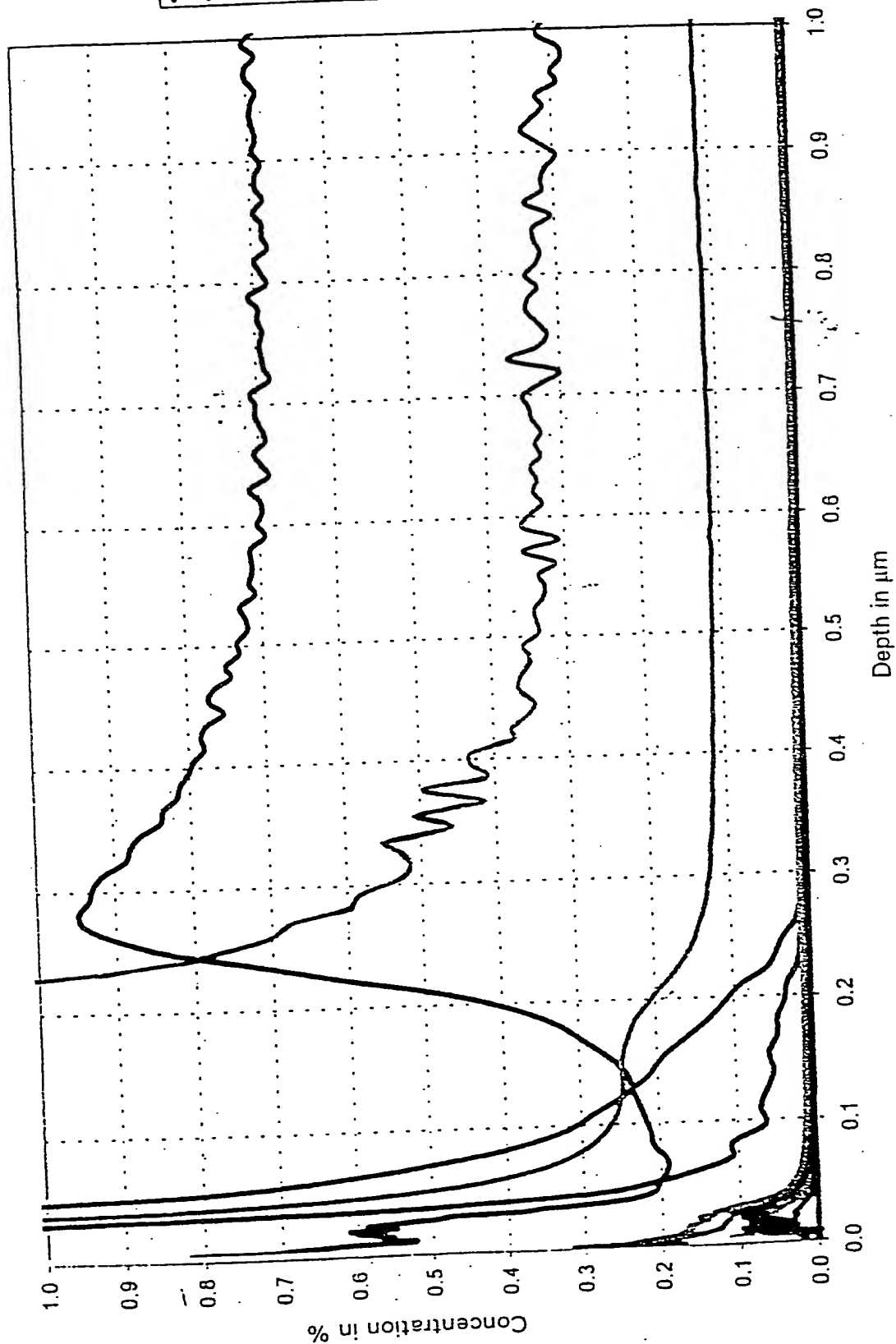


FIG. 26

FOET 20" E6640500

Diagram 1

Sample 7, Measurement Position A

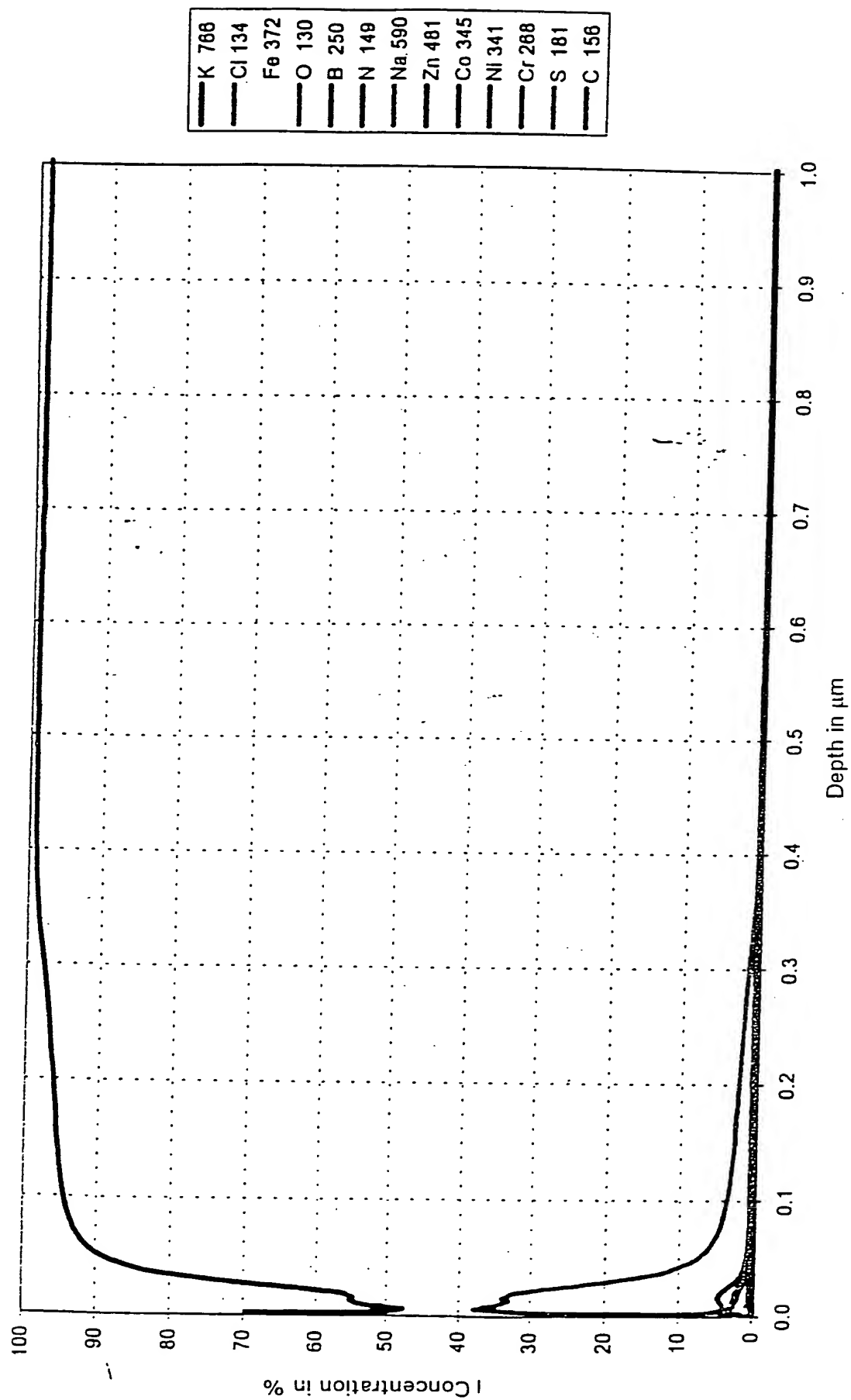


FIG. 28

Sample 7, Measurement Position A

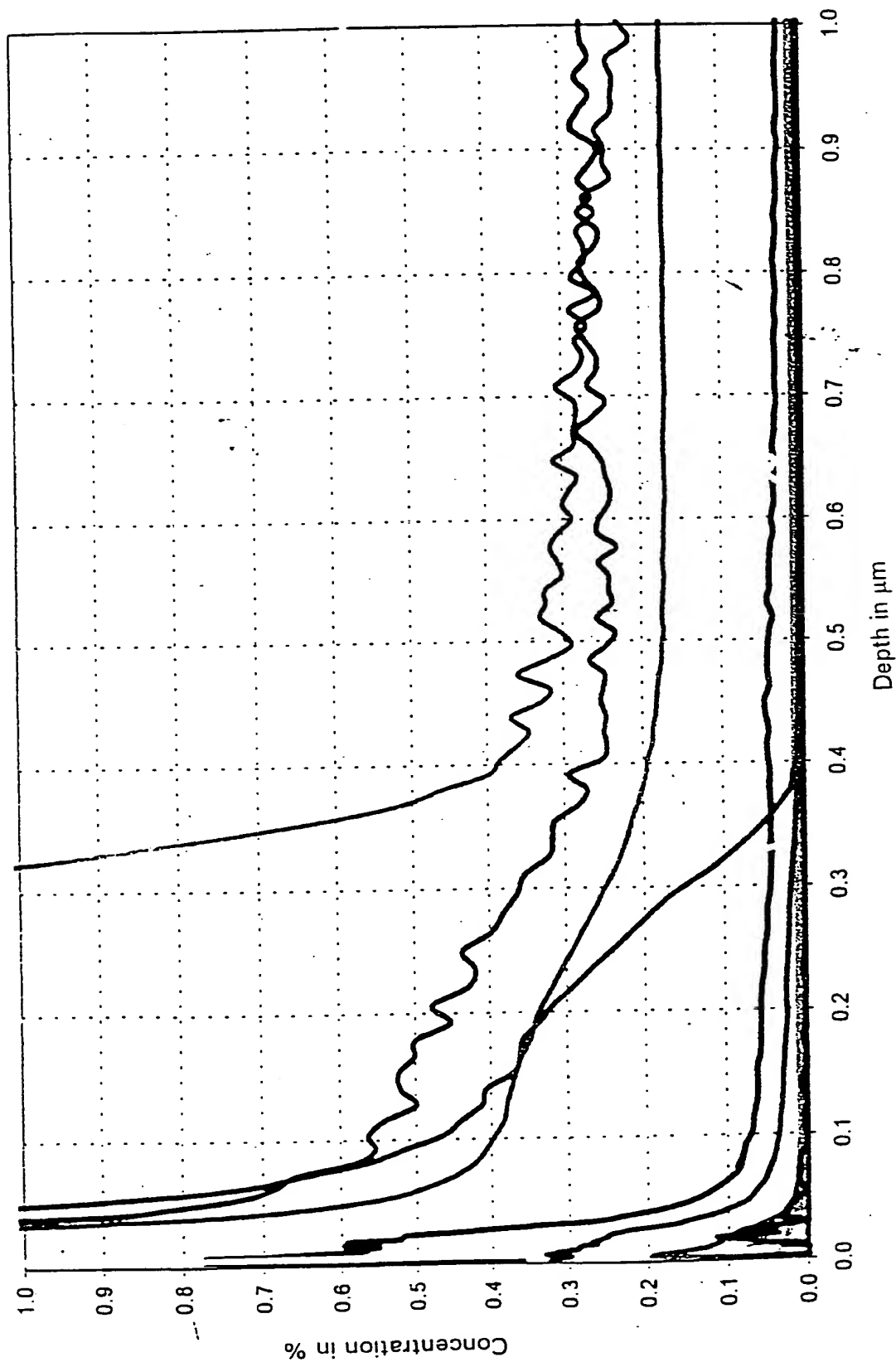
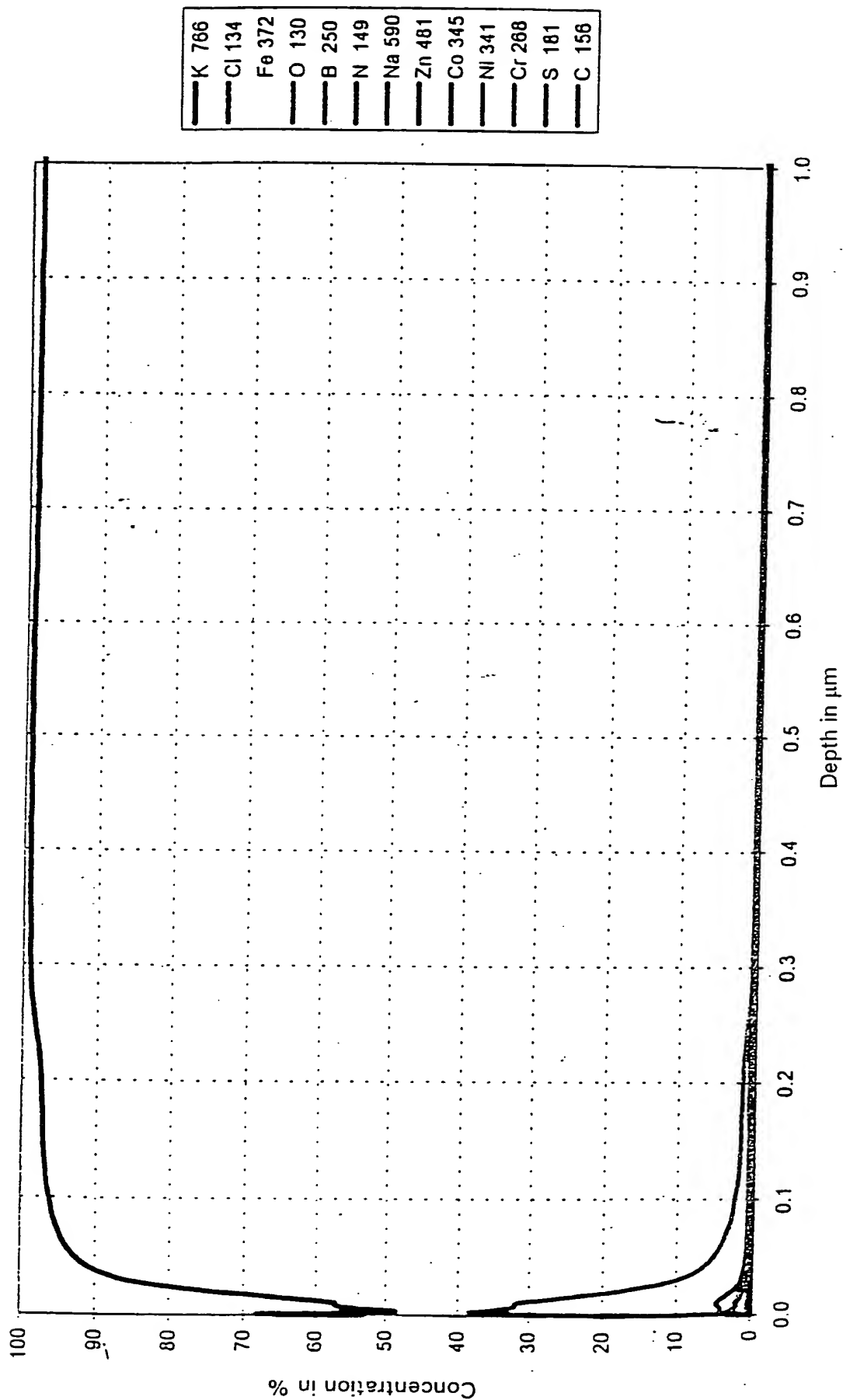


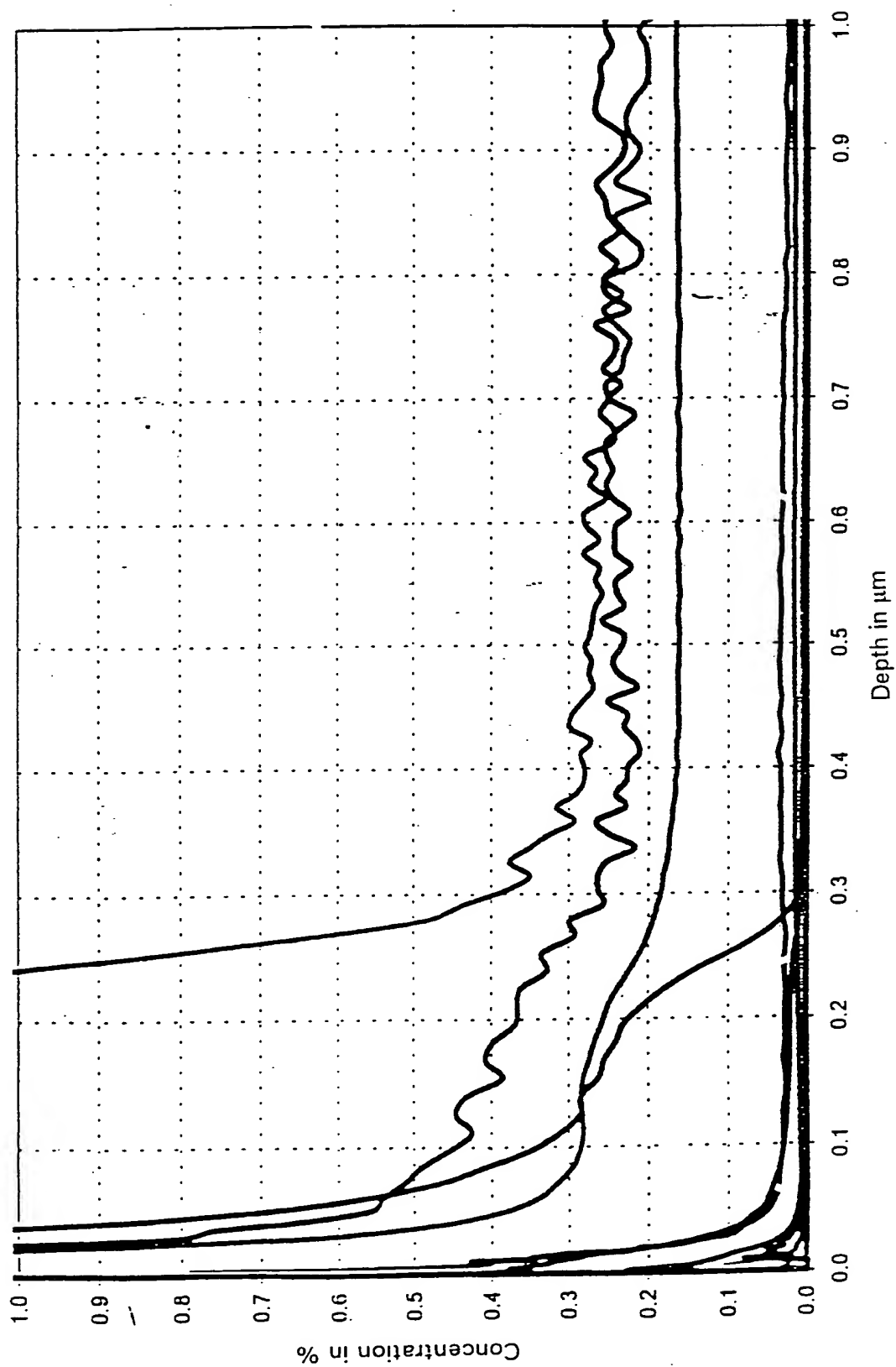
FIG. 29

Diagram 1

Sample 7, Measurement Position B



| | |
|---|--------|
| — | K 766 |
| — | Cl 134 |
| — | Fe 372 |
| — | O 130 |
| — | B 250 |
| — | N 149 |
| — | Na 590 |
| — | Zn 481 |
| — | Co 345 |
| — | Ni 341 |
| — | Cr 268 |
| — | S 181 |
| — | C 158 |



Sample 7, Measurement Position B

FIG. 30

FIG. 31

Sample 8, Measurement Position A

Diagram 1

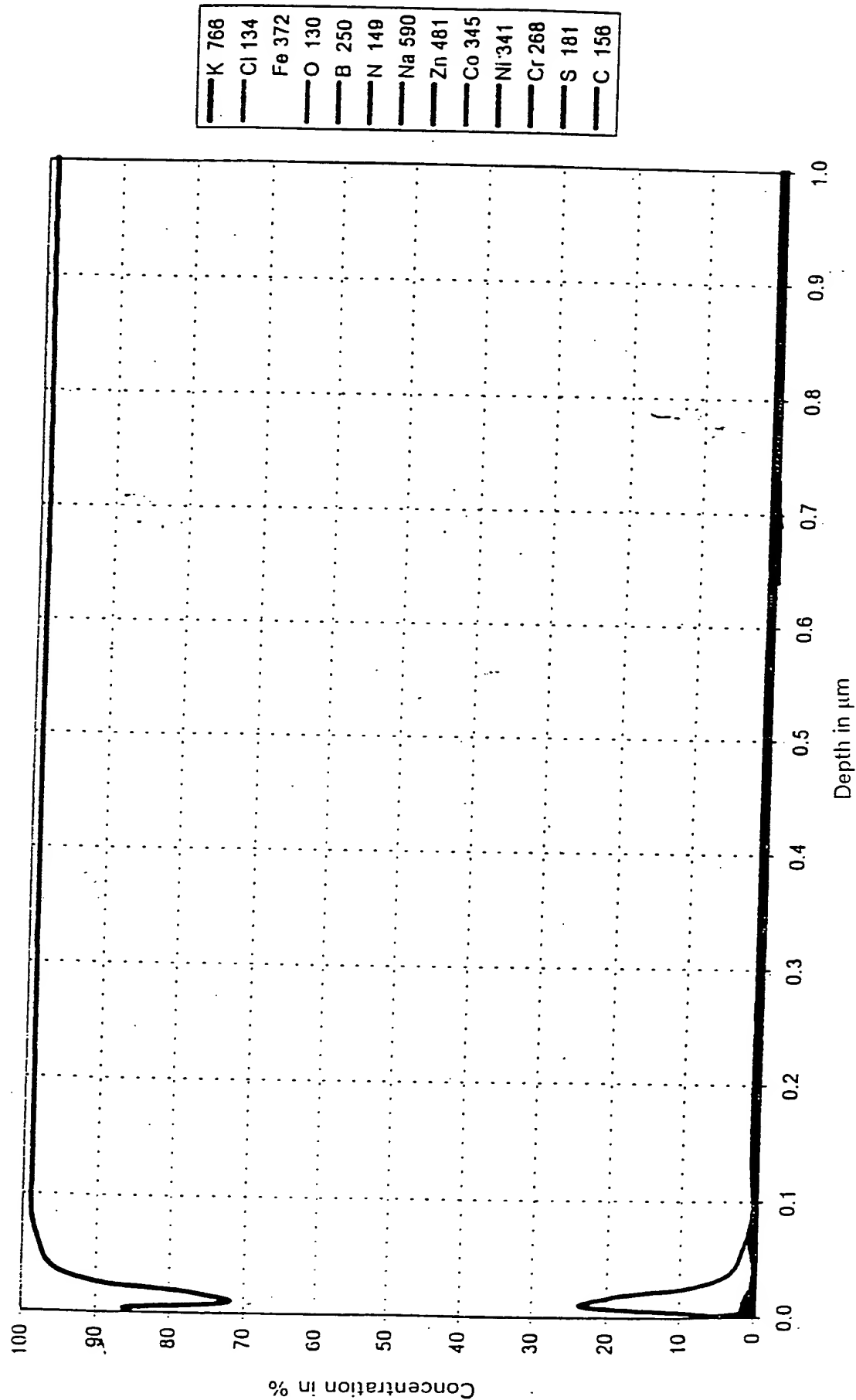
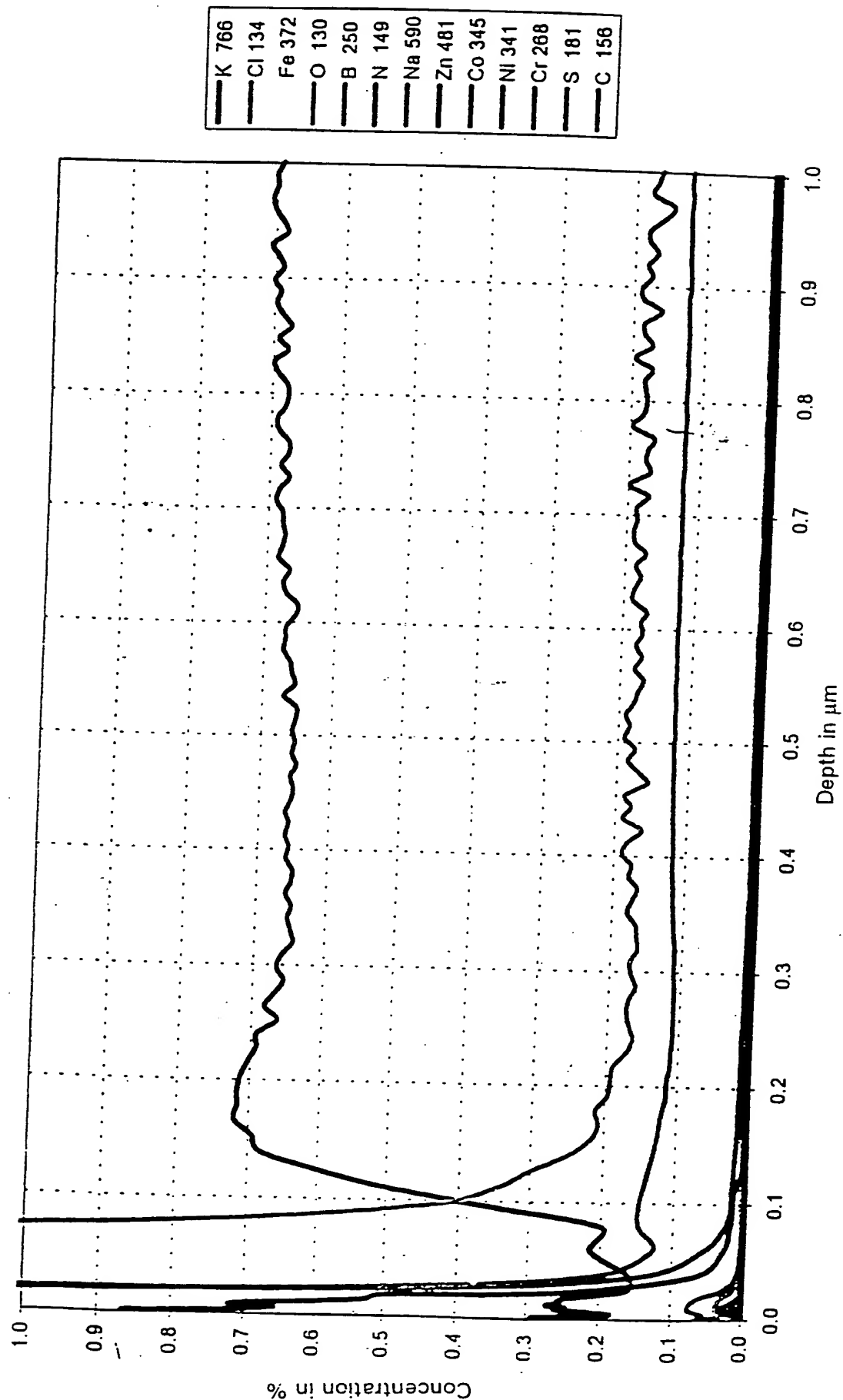


Diagram 2

Sample 8, Measurement Position A



| | |
|---|--------|
| — | K 766 |
| — | Cl 134 |
| — | Fe 372 |
| — | O 130 |
| — | B 250 |
| — | N 149 |
| — | Na 590 |
| — | Zn 481 |
| — | Co 345 |
| — | Ni 341 |
| — | Cr 288 |
| — | S 181 |
| — | C 156 |

FIG. 33
THE DIAGRAM 154060

Sample 9, Measurement Position A

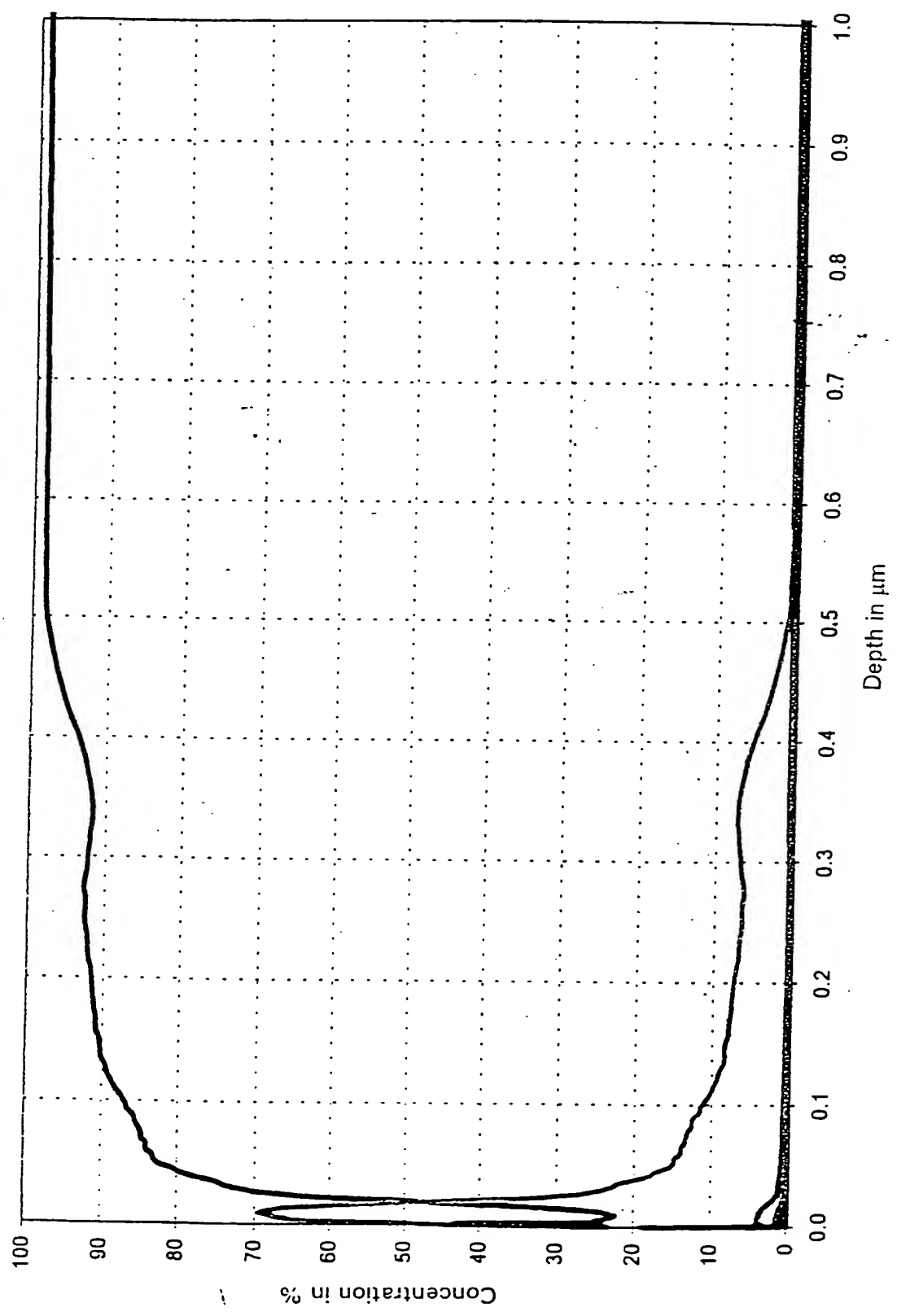


FIG. 34

Sample 9, Measurement Position A

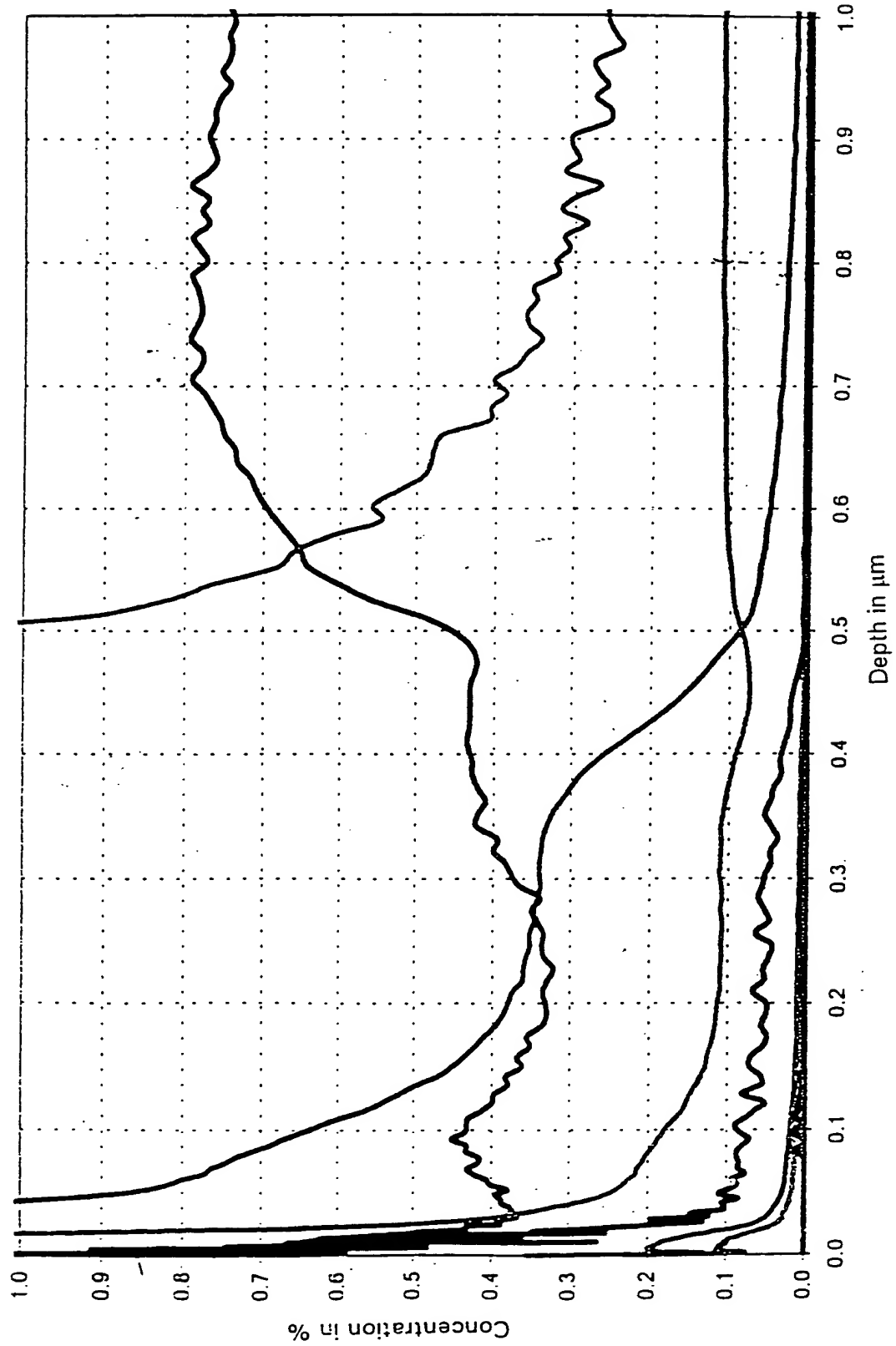


FIG. 35

Sample 9, Measurement Position B

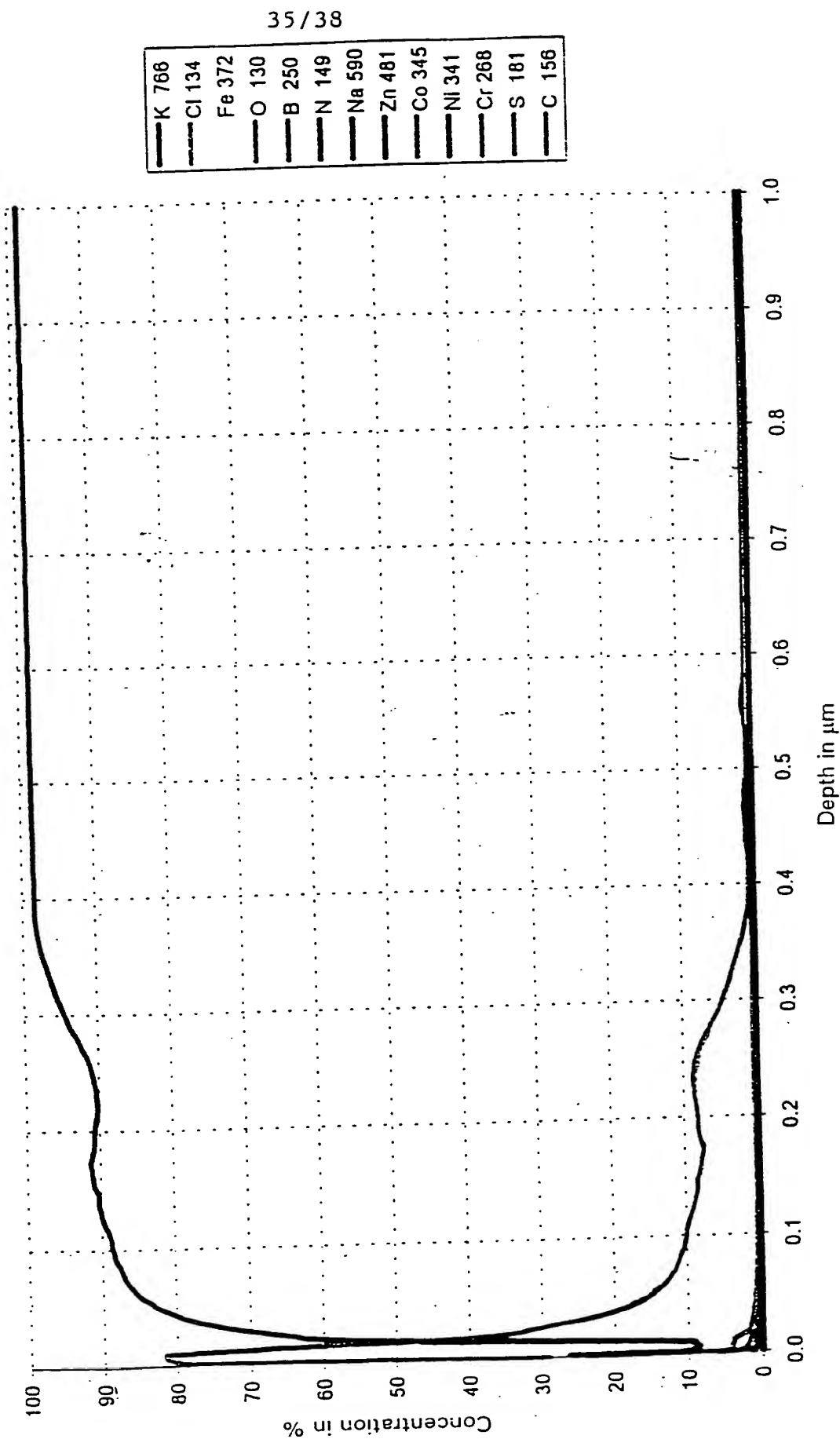


Diagram 2

Sample 9, Measurement Position B

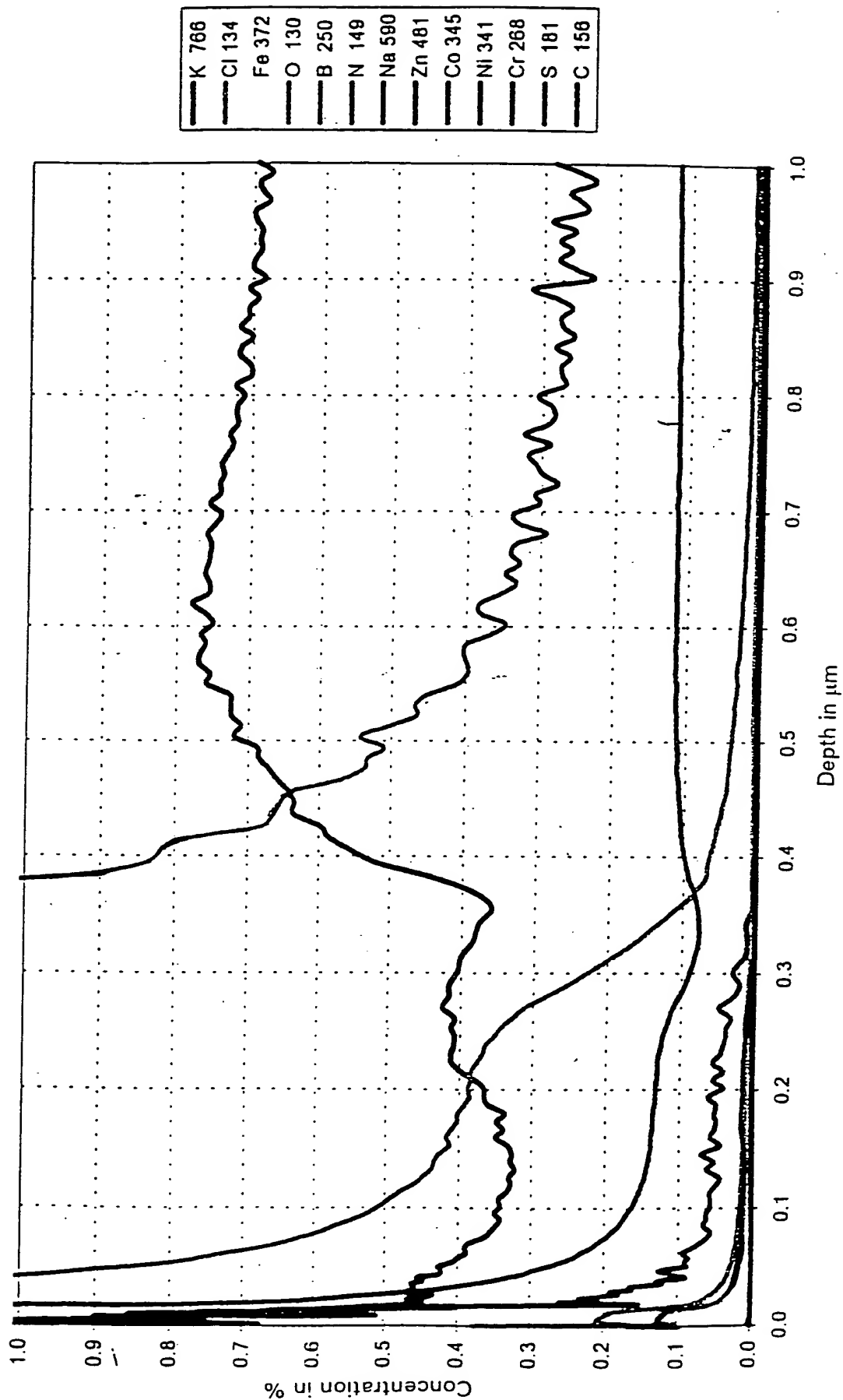
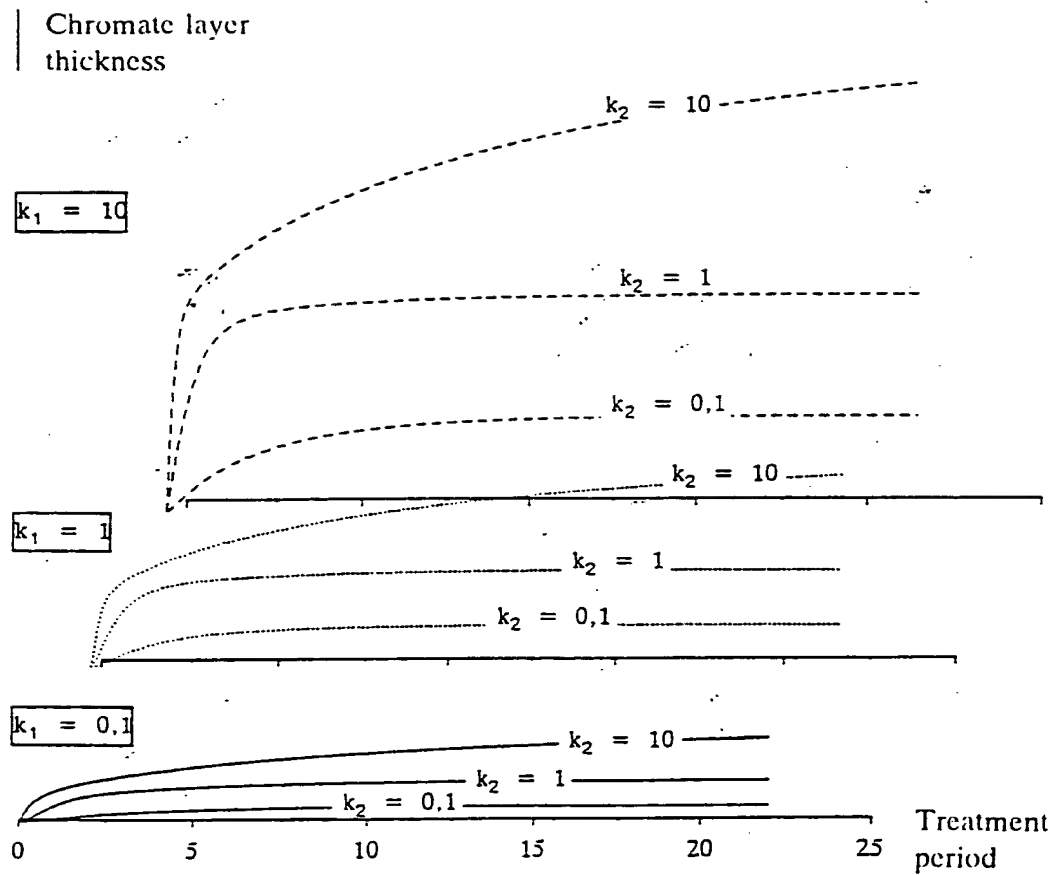


FIG. 37

| | Methods | | | Glow-discharge spectrometer | | | | Sample No. |
|--|--------------------|-----------|--------------|-----------------------------|----------------|--------------|----|------------|
| | Ellipsometry nm | SEM nm | nm (Cr > 1%) | with Cr (%) | chromium index | nm (Cr > Zn) | | |
| 1. Prior Art | | | | | | | | |
| Yellow chromation Cr(III) + Cr(VI) | - | 300 | 440 | 11 | 48 | 17 | 25 | 9 |
| Blue chromation Cr(III) | 98 | 60 | 60 | 8 | 5 | 0 | 0 | 8 |
| 2. Invention (Chromitization) | | | | | | | | |
| 60 °C Cr(III) | 432 | 300 | 344 | 7 | 23 | 2 | 15 | 1,2,3,4,5 |
| 100 °C Cr(III) | 595 | - | 358 | 10 | 38 | 22 | 28 | 6 |
| 60 °C on Zn/Fe Cr(III) | - | - | 282 | 6 | 16 | 0 | 16 | 7 |
| 100 °C, two-fold concentration Cr(III) | 953 | - | - | - | - | - | - | - |

Fig. 38

38/38



Computer simulation of the kinetic model of chromate coating of zinc for various rate constants